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Iowa Water Quality Management Plan Skunk River Basin

Iowa Dept of Environmental Quality, Des Moines

Jul 76

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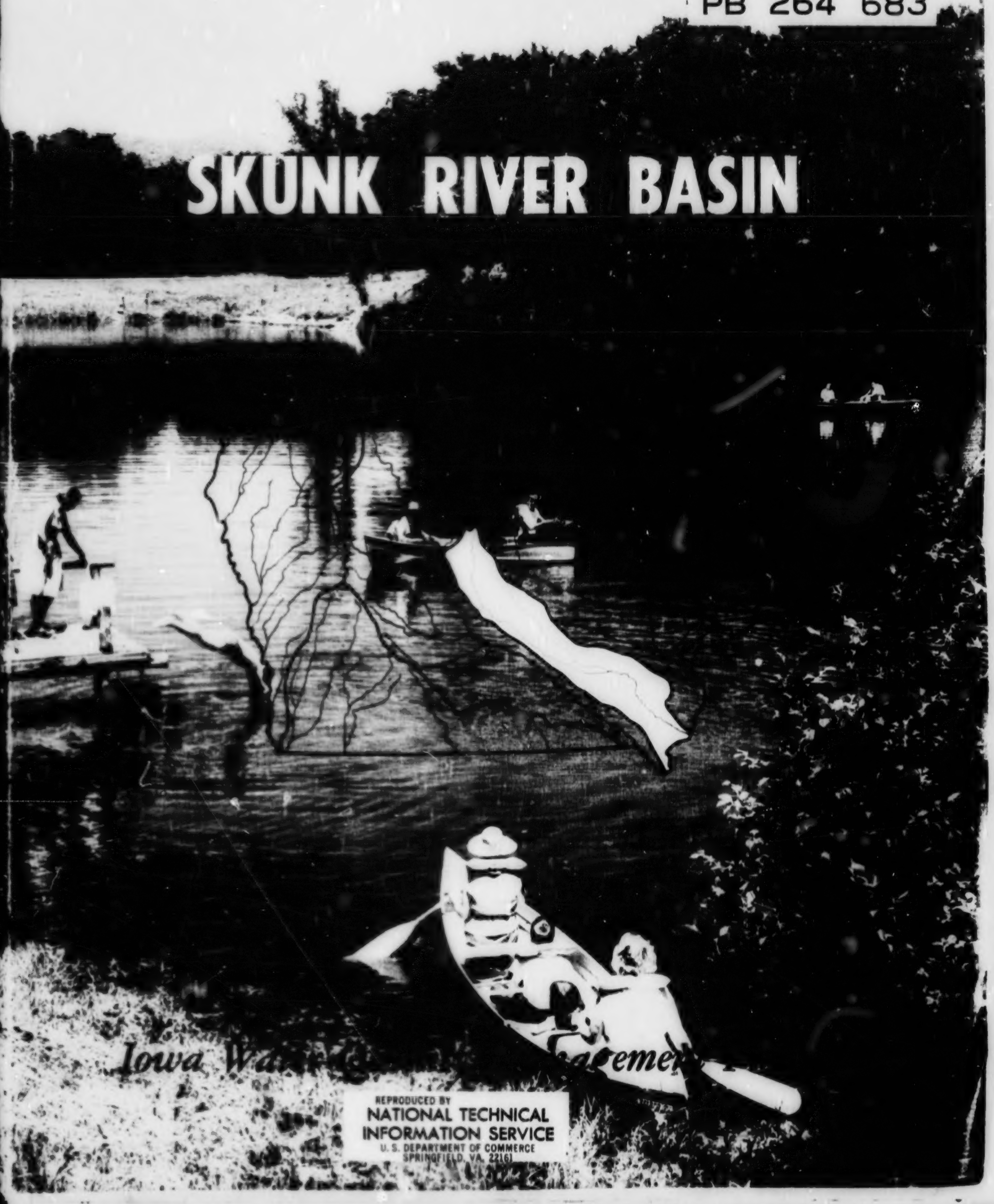
SKUNK RIVER BASIN



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16. ABSTRACT

This basin plan is for one of six major river basins partially located in Iowa. These plans fulfill Phase I requirements of Section 303(e) of Public Law 92-500, the Federal Water Pollution Control Act Amendments of 1972. It includes a determination of existing water quality, applicable water quality standards, and significant point and nonpoint sources of pollution within the basin. Point source pollution abatement is the main emphasis of the plan. The plan contains effluent limits for point source wastewater discharges, compliance schedules to meet these limits, a priority ranking of municipal discharges for use in determining the distribution of Federal and State grant funds used in the construction and/or upgrading of municipal wastewater treatment plants, and a table of municipal and industrial wastewater treatment needs.

17. KEY WORDS AND DOCUMENT ANALYSIS

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The Iowa Water Quality Commission approval of these plans is limited to the criteria and strategies described in the plans. Specific effluent limits, compliance schedules and discharger rankings must be considered tentative. New information, growth patterns, industrial development, grant funds and numerous other factors will require that the operation permits issued to each discharger reflect the most current information available and therefore they may vary from the values and the dates contained in the plans.

WATER QUALITY MANAGEMENT PLAN
SKUNK RIVER BASIN

July, 1976

PLANNING AND ANALYSIS SECTION
WATER QUALITY MANAGEMENT DIVISION
IOWA DEPARTMENT OF ENVIRONMENTAL QUALITY

ACKNOWLEDGMENT

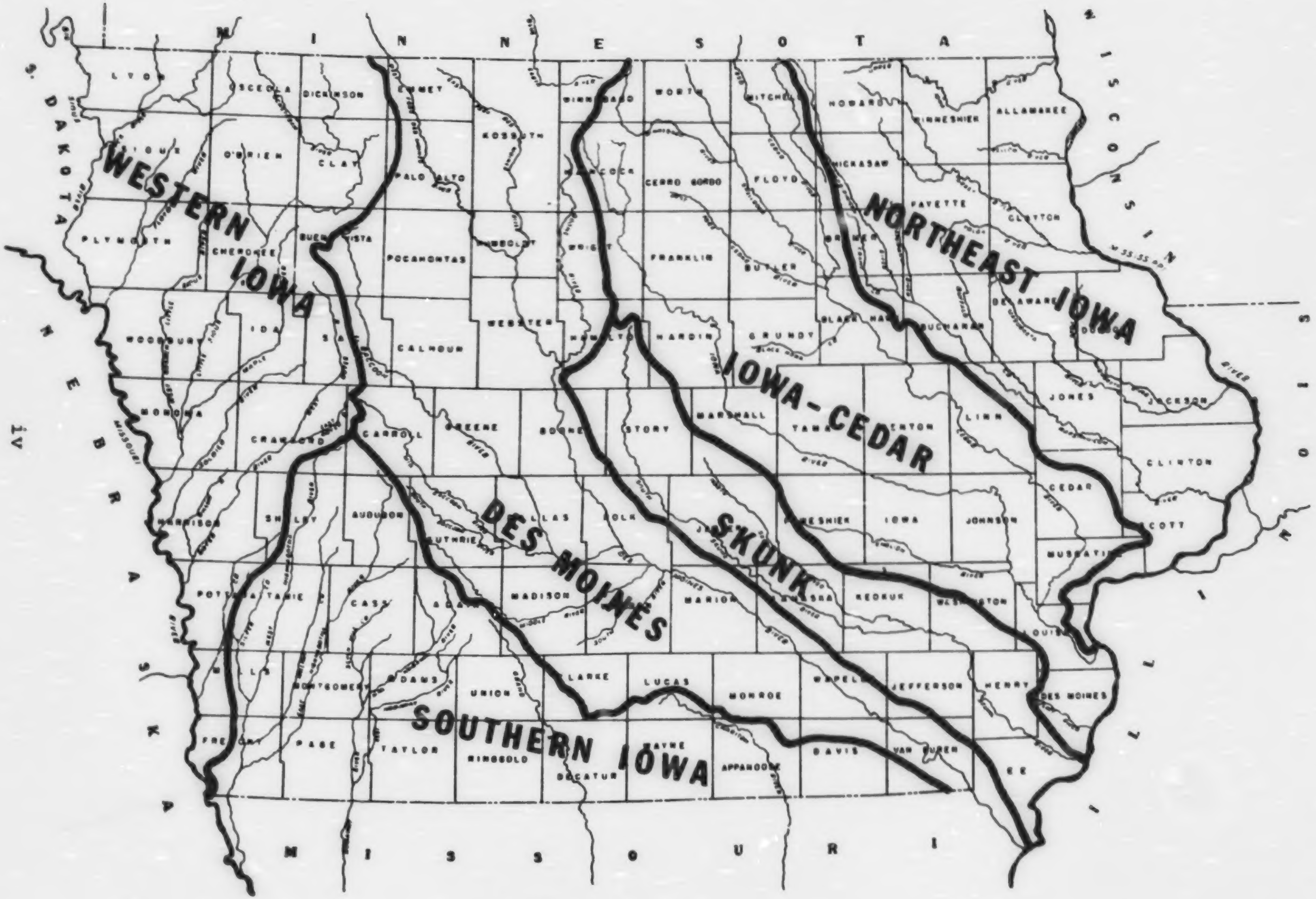
We gratefully acknowledge the assistance of the many State and Federal agencies and individuals that have provided data, reviewed drafts, and helped in other ways during the formulation and preparation of this water quality management plan. We also acknowledge the work of Stanley Consultants, Inc. in the development of the preliminary waste load allocation studies used in this plan.

FOREWORD

Under section 455B.31, Code of Iowa, 1973, the Iowa Department of Environmental Quality (DEQ) is charged with the responsibility of protecting and maintaining surface and ground water quality throughout the State. To assist the Department in this task, this basin plan has been prepared to coordinate and direct the State's water quality management decisions on a river basin scale.

The national goal, established in the Federal Water Pollution Control Act Amendments of 1972, (the Act), provides for water quality suitable for the protection and propagation of fish and wildlife, as well as for recreational activities in all surface waters by July 1, 1983. The Amendments define basin planning (Section 303(e)) as a key element for the determination and implementation of the necessary requirements to achieve national water quality goals.

Six major river basins, as defined by the Department of Environmental Quality, are partially located in the State of Iowa. Basin boundary lines are drawn to separate hydrological drainage areas (Figure 1). Any minor deviation from this is done only to be consistent with the boundaries of the six Iowa Conservancy Districts, as established by Chapter 467D.2 of the Code of Iowa. This provides the most compatible use of data among different State agencies.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DES MOINES
SOUTHERN IOWA
LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
O'BRIEN
CLAY
PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
DELAWARE
DUBUQUE
WOODBURY
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WEBSTER
HAMILTON
HARDIN
GRUNDY
BLACK HAWK
BUCHANAN
MONONA
CRAWFORD
CARROLL
GREENE
BOONE
STORY
MARSHALL
TAMA
BENTON
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DES MOINES
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
LEE
MISSOURI
RIVER

FIGURE 1
IOWA RIVER BASINS

This basin plan is one of a series for the six major river basins in Iowa. The planning documents will be prepared by the Water Quality Management Division of DEQ. The planning information contained herein is part of a continuing planning process. Changes will occur since this plan describes a dynamic process. Basin plans will be reviewed at least every five years with interim revisions as significant changes occur.

This plan includes a determination of existing water quality, applicable standards, and significant point and nonpoint sources of pollution in the Skunk River Basin. The plan then identifies and sets forth measures to correct the basin's water quality problems. Authority for this basin plan is derived from Section 455B.32, of the Code of Iowa.

This basin plan is specifically directed towards satisfying requirements of Section 303(e) of the Federal Water Pollution Control Act, as amended; Public Law 92-500, 86 Statute 816 (1972); (33 United States Congress 1251 et sequens). The plan will serve local and regional governments as well as State and Federal agencies.

SCOPE

This basin plan addresses the Skunk River Basin, which lies entirely within the State of Iowa. The basin encompasses an area from Northern Hamilton County to Southern Lee County where the Skunk River joins with the Mississippi River (Figure 2). Because it is a part of the same conservancy district, the Fort Madison-Keokuk area, drained by the Mississippi River and small tributaries, is also defined to be in the Skunk River Basin.

The scope of this plan entails the study of the following items: (1) Water Quality Management Programs, (2) Existing Development Patterns and Basin Characteristics, (3) Existing Water Quality, (4) Inventories of all Point Sources of Wastewater Discharge, (5) Assessment of Nonpoint Pollution Sources, (6) Stream Segment Analyses and Waste Load Allocations, and (7) Assessment of Needs and Compliance Schedules. The detail of the study of this document is as follows:

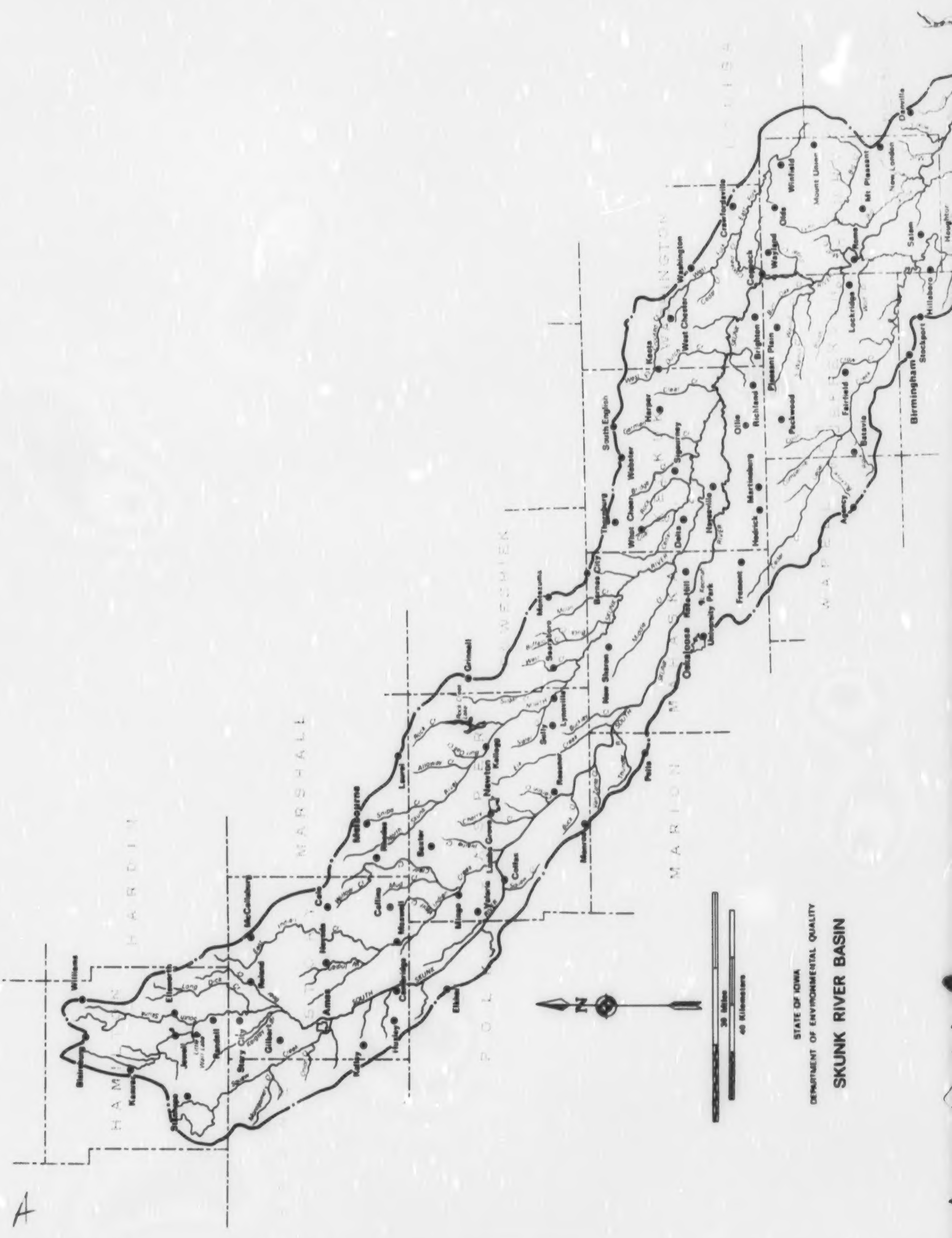
Chapter

I. Iowa's Water Quality Management Program

A synopsis of the basin planning process is presented along with a brief description of the DEQ's water quality management program and strategy.

II. Existing Development Patterns

Information concerning population, land use economics and recreational activities within the basin is presented.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Williams
Stanhope
Kamrar
Ellsworth
Jewell
Randall
Story City
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Roland
McCallsburg
Ames
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Grinnell
Monroe
Prairie City
Reasnor
Sully
Lynnville
Searsboro
Montezuma
New Sharon
Pella
Oskaloosa
University Park
Rose Hill
Barnes City
Thornburg
What Cheer
Delta
Webster
South English
Harper
Keota
West Chester
Washington
Sigourney
Hedrick
Martinsburg
Ollie
Richland
Fremont
Packwood
Pleasant Plain
Brighton
Coppock
Wayland
Olds
Crawfordsville
Winfield
Mount Union
Mt Pleasant
New London
Danville
Rome
Salem
Lockridge
Fairfield
Batavia
Agency
Birmingham
Stockport
Hillsboro
Houghton
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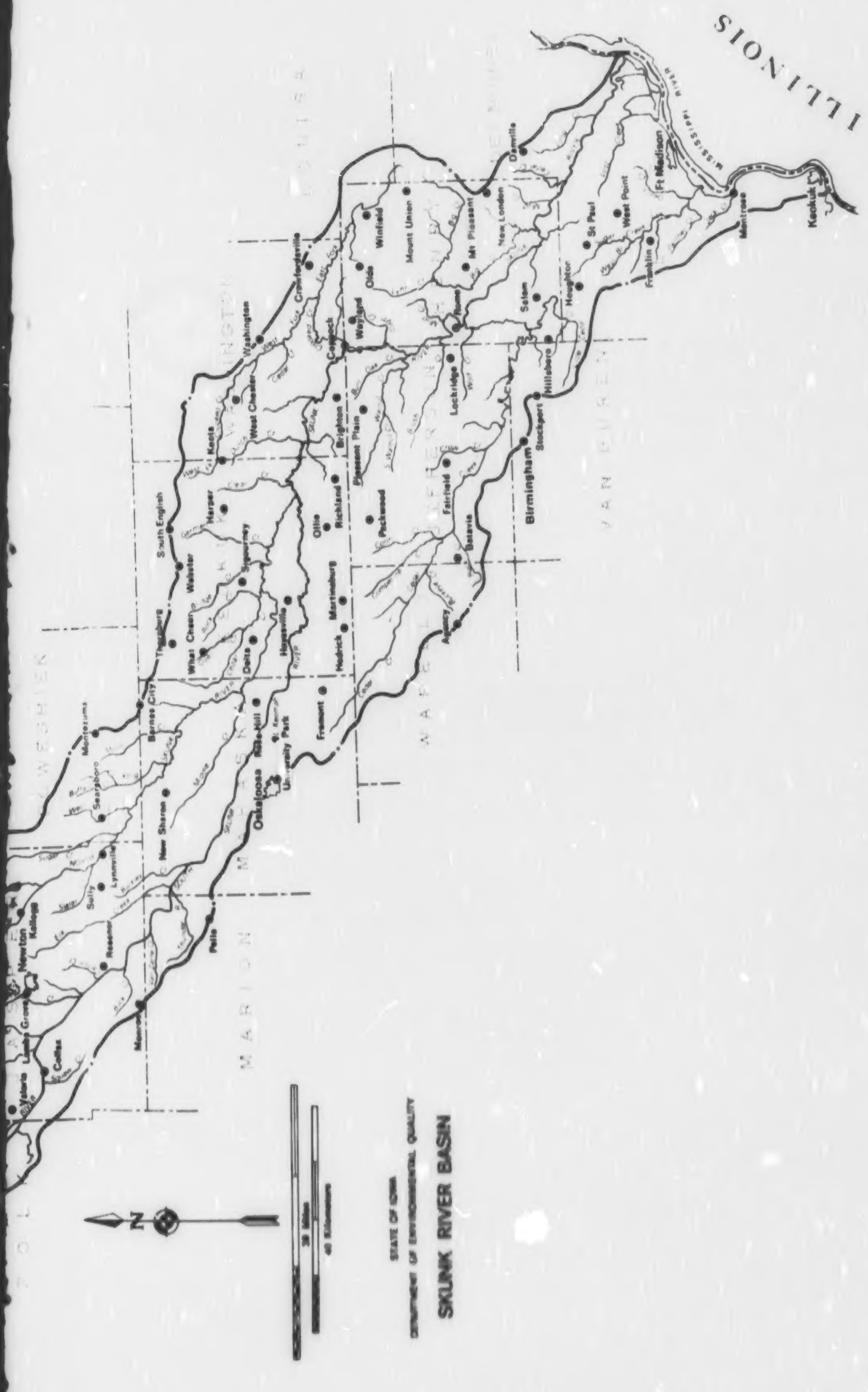
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SKUNK RIVER BASIN

A


SKUNK RIVER BASIN
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
N
ILLINOIS
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LEE
Colfax
Newton
Kellogg
Sully
Lynnville
Searsboro
Montezuma
New Sharon
Barnes City
Oskaloosa
Rose Hill
University Park
Pella
Fremont
Hedrick
Martinsburg
Delta
What Cheer
Thornburg
Webster
Sigourney
Hayesville
South English
Harper
Keota
Ollie
Richland
Packwood
Pleasant Plain
Brighton
West Chester
Washington
Crawfordsville
Coppock
Wayland
Olds
Winfield
Mount Union
Rome
Mt Pleasant
New London
Danville
Lockridge
Fairfield
Batavia
Agency
Birmingham
Stockport
Hillsboro
Salem
Houghton
St Paul
West Point
Ft Madison
Franklin
Montrose
Keokuk

B

FIGURE 2

III. Basin Characteristics

Basin characteristics, including topography, climatology, physiography, geology, hydrogeology hydrology, and groundwater quality are discussed.

IV. Water Quality

Iowa Water Quality Standards and Stream Classifications are delineated. Available water quality data have been accumulated and evaluated to present the best possible picture of the recent history of basin water quality. Existing water quality is described and then compared with the Iowa Water Quality Standards.

V. Point Source Discharge Inventory

Available records have been reviewed to determine the location and characteristics of point source wastewater discharges. This information is tabulated and summarized.

VI. Waste Load Allocations and Rankings

The results of the waste load allocation analyses for the basin are listed. Waste load reductions for each point source waste discharger are given. Segments are classified and ranked. Dischargers are ranked.

VII. Nonpoint Pollution Sources

The problems of nonpoint pollution sources are addressed. Combined sewer overflows, urban runoffs, and rural sources of pollution from animal feeding operations and general agricultural activities are characterized. Based upon information extrapolated from other areas, the potential pollution from typical sources is identified.

VIII. Needs and Compliance Schedules

An evaluation of the needs for improved wastewater treatment in the basin is presented. A summary of the estimated costs associated with these needs is also given.

IX. Conclusions and Recommendations

Conclusions drawn from the plan are presented along with several recommendations that would aid in attaining the goal of improved water quality.

X. Review and Revision

The procedures for review and revision of this plan are briefly described.

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CHAPTER I

IOWA'S WATER QUALITY MANAGEMENT PROGRAM

The main objective of water quality management is protection and enhancement of water resources to ensure acceptable conditions for designated uses. The establishment of a realistic management program requires a comparison of existing water quality with the desired water quality.

The Iowa Water Quality Standards, as adopted by the Iowa Water Quality Commission, establish a baseline for desired water quality and stream uses. The National Water Quality Criteria, as proposed by the U.S. Environmental Protection Agency (EPA), provides an additional measure of desirable water quality.

WATER QUALITY STANDARDS

Iowa's Water Quality Standards and accompanying use classifications were established by the Water Quality Commission. They were adopted by the State on February 12, 1974 and approved by the U.S. Environmental Protection Agency on March 26, 1974. When a water quality standard is violated, the water, according to law, is polluted and its quality must be improved.

Water Use Classifications

The Department of Environmental Quality has responsibility for establishment of water use classifications for the surface waters of the State. Assistance in this task has been provided by the State Conservation Commission which has the major responsibility for fish and wildlife protection. Accordingly, the DEQ has defined four surface water-use classifications and has placed all surface waters of the State into one or more of these classifications. These classifications are:

Class A - Primary Contact Recreation; Class B - Wildlife, Secondary Contact Recreation and Aquatic Life (with subclasses for cold and warm waters); Class C - Potable Water Supply; and a General Water Quality Criteria. All surface waters are designated under the General Water Quality Criteria. In addition, many streams are also designated for one or more of the Class A, Class B, or Class C uses. Each of the use classifications imply specific water quality standards.

Surface Water Quality Standards

Iowa Water Quality Standards define the constituent levels which may be present in the surface waters of the State. Specific concentrations of various constituents which should not be violated are assigned to each water use, in order to protect the water for that particular use.

The water quality standards shall be met at all times when the flow of the receiving stream equals or exceeds the seven day, 1-in-10 year low flow (7Q10). Exceptions may be made for intermittent or extremely low flow streams. When intermittent streams are classified for aquatic life protection, the Water Quality Commission may waive the (7Q10) low flow requirement and establish a minimum flow in lieu thereof. Such a waiver shall be granted by the Commission only when it has been determined that the aquatic resources of the receiving waters are of little significance at flows less than the established minimum.

The specific criteria which apply to A, B, C, or General classifications are detailed in Chapter II of the Supporting Document For Iowa Water Quality Management Plans (1).

Revision of Water Quality Standards

The Act requires that the State shall from time to time, but at least once every three years, hold public hearings to review water quality standards and, if appropriate, modify and adopt new standards.

Some of the most likely changes in the Standards will be revisions of the use classifications. Since the National water quality goal is swimmable-fishable waters by 1983, most anticipated changes will be to upgrade existing Class B waters to include the current Class A usage. There will also be cases of upgrading waters, to which only general criteria apply, Classes A and B. Other revisions that may take place are changes in the criteria of the current Water Quality Standards. Any revisions in the Standards will be subject to public hearings and approval by the EPA before they may become law.

IMPLEMENTATION STRATEGY

If a management plan is to be effective, it must include a strategy for implementation of its proposals. This section gives a brief description of the DEQ's strategy for the implementation of its basin plans.

Strategy Summary

In most cases, water quality violations are the result of man's activities. Typical sources of pollution can include municipal discharges, industrial discharges, and runoff or nonpoint discharges associated with agricultural practices. The solution to water pollution is to identify the contributing sources and either eliminate or control them to the extent necessary to assure that water quality standards will not be violated.

Waste load allocation studies are performed to estimate the quantities of pollutants which may be discharged to receiving waters without exceeding the limits allowed by the water quality standards. Through the use of the waste load allocations, effluent limitations are established for municipal and industrial wastewater point source discharges. Only point sources of pollution are addressed in the waste load allocations in the initial version of the basin plans. This is because point sources of pollution are easier to identify and control. Nonpoint sources of pollution will receive further considerations in subsequent revisions to the plans.

Regardless of what the waste load allocation study indicates, to be allowable, the Federal Water Pollution Control Act Amendments of 1972 (the Act), Public Law 92-500, requires publicly owned treatment plants to provide as a minimum, "secondary treatment", and industrial plants to provide, as a minimum, "best practicable control technology currently available" (B. P. T.) by July 1, 1977. The actual effluent limitations required under these degrees of treatment are described in Chapter VI.

The principal mechanism for attaining and maintaining compliance with the water quality standards is through the issuance of operation permits to all point sources of wastewater discharge. The permits contain either minimum allowable effluent limitations or limitations more stringent as necessary to assure compliance with water quality standards. Where existing sources are not in compliance with the effluent limitations, the operation permit will include an implementation schedule to assure compliance within a reasonable time period.

An additional step in the implementation of remedial measures to abate water pollution exists in the case of municipal wastewater treatment plants. Public Law 92-500, the Act, has established a program for assisting publicly owned waste treatment works with funding for improvements necessary to meet the goals of the Act. The DEQ, as the state water pollution control agency, has responsibility for administering the program. The final step, then, in the DEQ's strategy for implementation of the plan is to allocate the federal funds available for improvement of Iowa municipal treatment facilities.

Monitoring and Surveillance

Stream Sampling Station Network - The present Iowa stream sampling station network is a series of sampling points distributed throughout the State. These are permanent stations, sampled at the same location and on a quarterly frequency. The samples are normally analyzed for the same parameters every quarter. The objective of the sampling network is to give a general indication of water quality. The network is effective for measuring trends of either improvement or degradation of water quality. Although only minimal assistance is obtained in the area of enforcement, the network provides some background data for planning and assessing the effectiveness of the program.

The present network consists of thirty-six (36) stations across Iowa, each sampled quarterly. One of these stations is in the Skunk River Basin. The station is located on Big Creek, near Mount Pleasant. All stations are sampled by the State Hygienic Laboratory of the University of Iowa, under contract to the DEQ. The State Hygienic Laboratory also does the analyses.

In order to be more effective as a trend indicator, the monitoring network should be expanded. To be most effective, stations should be located below major point source discharges, and at points on the stream of distinct change in characteristic. These locations would be at points of confluence of major tributaries, above and below impoundments, and at points of change of water quality standards designation.

Intensive Stream Water Quality Surveys - The limiting factor in the effectiveness of the stream sampling network is its inability to detect cause and effect relationships. The DEQ's water quality monitoring program therefore includes a complementary program of intensive stream water quality surveys. The intensive surveys are in-depth studies of water quality in a specific area or segment of a stream, over a finite time period. The purpose of the survey is to provide a detailed determination of the biological, physical, and chemical qualities of the stream water. Information obtained is used to determine the effects of a specific point source or combination of point sources upon the receiving stream. The surveys provide documentation for enforcement actions and determine the effectiveness of any corrective measures initiated. Such surveys are also used for evaluating priorities, verifying waste load allocations, and as aids for planning.

The bulk of the intensive surveys program is conducted by the State Hygienic Laboratory. The lab usually performs both sampling and sample analyses. Intensive surveys are also conducted by the DEQ staff to obtain answers to specific questions. For example, limited surveys are occasionally conducted by DEQ Regional staff in connection with point source discharge compliance inspections.

All survey data storage and analysis are performed using computer data processing. The stream water quality data is also stored in the U.S. Environmental Protection Agency computer storage system, STORET. The STORET system includes a variety of report and analysis formats for evaluating and using the data.

Point Source Discharge Self-Monitoring - The principal tool for the management of point source discharge monitoring and enforcement of effluent limitations is the State Operation Permit Program, in coordination with the National Pollutant Discharge Elimination System (NPDES Discharge Permit Program). The permits not only set discharge effluent limitations and prescribe compliance schedules for bringing about corrections, but also specify a program for effluent monitoring and recording by the permit holder.

Dischargers are currently required to report to the DEQ each month. Report contents are specified and are tailored to the size and complexity of the plant and to the effluent limitations specified in the permit. Plant flows are required to be recorded as well as certain laboratory test results.

The self-monitoring reports are used as a screening mechanism to point out operation problems and existing or impending effluent limit violations. The reports are used as a guide to direct the DEQ resources to the needs for more detailed monitoring and possible enforcement action.

More importantly, however, the reports serve as an aid to the operator in evaluating his own operation. The requirements in effect mandate the availability of operational data which the operator can then use to improve his operation.

Another self-monitoring program is the State initiated Effluent Quality Analysis Program (EQAP). This is a program where the State Hygienic Laboratory mails specially prepared sample bottles to each discharger. The plant operator collects a sample at times and locations recommended by the DEQ, and mails the sample back to the State Hygienic Laboratory for analysis. Samples are analyzed monthly for biochemical oxygen demand (BOD) and, in some cases, ammonia. Other water quality parameters compatible with acid fixing can also be analyzed from the EQAP sample. Occasionally, heavy metal or phosphorus analyses are performed at the request of the DEQ.

Plant Inspection - The DEQ also conducts on-site plant inspections. The purpose of the inspection is to provide an in-depth analysis of the operation, maintenance, and effectiveness of the treatment plant. The inspections provide verification of self-monitoring reports and determination of whether the plant is in compliance with permit stipulations.

Influent and effluent samples are collected and analyzed when possible, but in many cases visual observations of the effluent by the inspector can satisfactorily make the determination. The inspection also includes an evaluation of the effects of the effluent on the receiving stream, occasionally by sampling, but more often by visual observation.

The advantage of the on-site inspection over the other monitoring programs is the opportunity to make cause and effect evaluations. The inspector can observe the raw waste load and the operation and maintenance factors which determine the efficiency and effectiveness of the treatment process.

The value of the inspections is twofold; first, they provide a valuable tool for evaluating permit compliance and documenting the need for enforcement actions, and secondly, and equally important, they provide a vehicle for assistance to the operator. The inspectors can provide counsel and advice to the local officials on meeting permit requirements as well as operation and maintenance methods to improve plant operation and efficiency.

Plant inspections are normally made by the DEQ regional staff. The regional staff make the inspections when minimal or no sampling is needed in conjunction with the inspection. Central office staff make inspections when intensive composite sampling is required. The number of inspections conducted each year is limited by the availability of fiscal and personnel resources. Approximately three to four hundred municipal and industrial inspections are made each year, along with a similar number of quick stop visits. All municipal and major industrial plants should be inspected each year. The number of inspections will be increased as staff is added to the Regional offices.

Waste Load Allocations

Waste load allocations have been made for point sources of wastewater discharge in order to maintain water quality standards. The scope of the allocations was limited to evaluation of effluent limitations necessary to meet the dissolved oxygen (DO) and ammonia-nitrogen (NH_3-N) standards, at the 7-day, 1-in-10 year low stream flow.

The DO and NH_3-N parameters were selected for evaluation because they are generally the most critical criteria of the water quality standards. Data from five years of municipal treatment plant effluent sampling are available on these parameters and are readily adaptable to data processing. Other criteria within the water quality standards can normally be met with secondary treatment.

It is recognized that other parameters could be considered in the waste load allocation analyses. An analysis of historical water quality data shows that other water quality criteria have been violated and that critical conditions may also exist for some parameters during high stream flow periods. Some other parameters of particular concern include heavy metals, toxic elements, fecal coliform and thermal discharges. Where standards violations are apparent for parameters other than DO and NH_3-N they are studied on an individual basis and effluent limits incorporated into the operation permits. A more detailed waste load allocation analysis, however, will have to be left until subsequent revisions of this plan when additional data and information become available.

To predict the variation in DO and ammonia concentrations in the streams, a computer-based mathematical model was used. Input data for the model was developed from existing information and cursory field investigations of the streams. When necessary, conservative assumptions have been made that tend to assure a high degree of protection for water quality without necessitating unrealistically stringent effluent limitations. Future stream surveillance should help to verify particular constants and assumptions used, and improve the validity of the model. Based upon existing data prediction of the impact of different wastewater loads upon the DO and ammonia concentrations may be performed.

A detailed discussion of the mathematical model, methodology, and assumptions used in the waste load allocation analysis is included in Chapter IV of the supporting document (1). The final allocations for the Skunk River Basin are contained in Chapter VI of this report.

Permit System

The major mechanism by which the water quality management plan will be implemented is the wastewater construction and operation permit program conducted by the DEQ, under authority of Chapter 19, of the rules of the Department (1973 IDR). Any person intending to construct, modify or extend any wastewater disposal system in the State of Iowa must first obtain a construction permit from the Executive Director of DEQ. An operation permit is also required prior to the operation of any disposal system, or the discharge of sewage, industrial waste, or other wastes from any discharge source. Chapter 455B of the Code also has provisions included for correcting violations of any permit, rule, standard, or order issued under Part 1 of Division III of the Chapter.

NPDES - The Federal Water Pollution Control Act Amendments of 1972 (the Act) established a National Pollutant Discharge Elimination System (NPDES) permit program. Any person presently discharging wastewater to public waters is required to obtain an NPDES permit. Any person proposing a disposal system which will result in a wastewater discharge is required to apply for an NPDES permit at least 180 days before such discharge is to commence.

The Act also established a procedure whereby the EPA can delegate permit authority to those States that desire to administer the NPDES program. The State must demonstrate ability to conduct the program and must have adequate legal authority to enforce the permits. The DEQ is currently preparing a delegation request to the EPA for issuance of NPDES permits in Iowa.

Operation Permits - An operation permit is a legally enforceable document which specifies the type of waste water which may be discharged, as well as the allowable quantities, concentrations, and rates of discharge. As a minimum, the effluent limitations are equivalent to secondary treatment for municipalities or BPT for industries, but, more stringent limits may be required as needed to meet water quality standards.

The permits also contain self-monitoring and reporting provisions that require dischargers to monitor their effluents and report the results to the DEQ. The DEQ data processing system stores and reports the water quality and compliance schedule data in formats designed to point out violations and problem areas. Fiscal and personnel constraints limit the number of violations and problem areas that can be effectively pursued. Staff resources are, therefore, directed to those discharges which are determined to be of sufficient importance by the priority ranking formula.

Provisions of the State construction and operation permit program also require that certain agricultural operations also obtain a permit for wastewater disposal. This subject is discussed in Chapter VII. Industries which discharge their wastewater to municipal plants do not need an operation permit, but must follow certain pre-treatment standards as published by the EPA.

Operation permits are written for a maximum of five years, with renewal application required prior to expiration. A permit can be modified at any time if there is a violation of any terms or condition of the permit, a change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge, or if it is found that the permit was obtained under any type of misrepresentation of fact.

Many dischargers are not currently treating their wastewaters to a sufficient degree to comply with the final effluent limitations of their permit. In these cases the permits are written with interim and final effluent limitations and legally enforceable compliance schedules. These compliance schedules usually specify a series of interim dates so as to assure steady progress on the remedial efforts.

Iowa water pollution control law provides for stiff penalties for violations of permits and other rules or standards. A large bulk of the DEQ compliance action work load is directed toward negotiating achievable timetables. Negotiations are aimed at identifying practical remedial measures. Legal enforcement actions then follow only where negotiations are not effective.

Water Quality Management Deadlines

As already mentioned, this document will help to direct the water quality management strategies necessary to implement a remedial program needed to meet the goals of the Act. The Act and DEQ specify several deadlines that must be met in the implementation of this management program. Following are several key dates which have been established both by the EPA and DEQ for improving wastewater treatment to protect National and State water quality. These dates are used to establish implementation schedules for the remedial measures defined by this plan.

Date	Action
December 31, 1974	National Pollutant Discharge Elimination System permits issued.
June 30, 1975	Section 303(3) basin plans completed.
July 1, 1977	Secondary treatment required for all publicly-owned treatment works.
July 1, 1977	Best practicable waste treatment technology for all industrial discharges.
July 1, 1977	More stringent effluent limits to meet Iowa water quality standards.
July 1, 1983	Best practicable waste treatment technology for all publicly-owned treatment works.
July 1, 1983	Best available technology for all industrial discharges.
July 1, 1985	Zero pollutant discharge.

Construction Grants

If all point source dischargers are to meet the effluent limitations imposed by the waste load allocations, considerable monetary expenditures will be required on behalf of municipalities and industries. Industrial dischargers must provide their own waste treatment financing. The Federal Water Pollution Control Act Amendments of 1972, under Title II - "Grants for Construction of Treatment Works" provide for federal grants for publicly owned waste water treatment facilities. Municipalities may apply to the EPA through the DEQ for federal grants of 75% of eligible costs of their wastewater treatment works improvements. Municipalities must then provide from other sources, the remaining 25% of the cost. Eligible project costs include those for treatment, interceptors, and collection facilities. Collection facilities have been assigned lowest priority.

In the past, federal funds allocated to Iowa had been sufficient to cover the grant funding of all needed treatment facilities, however, during the past two years the needs have outgrown the availability of federal funds. Nationwide federal allotments for fiscal years 1974 and 1975 were $3 billion and $4 billion, respectively. Of the national allotment, Iowa's shares were $34.7 million and $39.3 million respectively. Current needs for the State for all eligible facilities excluding storm sewers, based on 1973 dollars is $989,584,000, as contained in the 1974 "Needs Survey" for the State of Iowa. These needs will continue to increase as better information is developed through the waste load allocations and basin planning processes. Inflation is also having a significant influence on treatment facility costs.

Priorities for Funding - To receive grant funding a municipality must proceed through certain requirements. The DEQ is responsible for establishing an orderly priority process for the administration and obligation of federal grant funds. All municipalities are placed on the state discharge inventory and assigned a discharge priority. Should a municipality have a need for improvement or construction of wastewater treatment facilities and apply for federal grant funds, it is then placed in the construction grant priority listing according to its discharge priority rank. The construction grant priority list is revised annually. After determination of the available federal grant money for the year, the annual project list can be established based upon the number of projects from the priority list that can be funded.

Prior to adoption of the annual "priority list" and "project list" for each fiscal year, a public hearing is held where interested persons may comment on the proposed lists. Following consideration of public hearing comments the final lists are prepared and approved by the Water Quality Commission and the EPA.

Types of Grants - Once a municipality has been placed upon the "project list" and has been found to be eligible for grant funding, a three-step grant process in initiated in accordance with Federal Regulations 40 CFR 35, promulgated by the EPA to implement Title II of the Federal Act.

Step one, known as the facility plan, contains an evaluation of the water pollution control problem; explores a number of alternatives to eliminate the problem; conducts a cost-effectiveness study for each alternative; evaluates the environmental impact of each alternative; and finally, chooses the specific alternatives which seem to have the most environmental, economic, and social benefits. The facility plan must be submitted to the DEQ and the EPA for approval before the second step can be considered.

Step two covers the preparation of construction plans and specifications which are based on the alternative chosen in the facility plan. After approval of the plans and specifications by the DEQ and the EPA, step three, which is the actual construction of the required facilities, can be initiated. Grants are made to applicants for each of the three steps.

Before the facility planning (Step 1) process is begun, the DEQ will inform the applicant of the minimum quality of effluent which can be discharged to the receiving waters. The facility planning for a specific discharge is then directed at meeting these effluent limitations.

Priority System

Application of the waste load allocations and effluent limitations result in considerable needs to upgrade or expand existing wastewater treatment facilities. Although there is considerable expense involved to meet State and Federal water quality goals, the financial resources available each year for publicly owned facilities are limited. Not all needed projects can be funded at once. To solve this problem, a system of priorities has been established. This section describes a portion of the system proposed for use by the State of Iowa.

Stream Segment Priority Ranking - Each major river basin is first divided into various stream segments. Each stream segment consists of surface waters that have common hydrologic characteristics and natural, physical, chemical, and biological processes. In accordance with EPA guidelines, the stream segments must be classified either effluent limited (EL) or water quality limited (WQ).

Segment classification is a contributing factor in the determination of the segment ranking, discharger ranking, and compliance scheduling. The two segment types are described as follows:

1. An effluent limited (EL) segment is any segment where it is known that water quality is meeting and will continue to meet standards, or where there is adequate demonstration that standards will be met after application of secondary treatment or BPT to all point discharges to the segment.

2. A water quality limited (WQ) segment is any segment where it is known that water quality does not currently meet applicable standards and it is not expected that standards would be met even after application of secondary treatment or BPT to all point discharges to the segment.

All segments are next ranked in order of abatement priority. The ranking methodology attempts to take into account: (1) severity of pollution problems, (2) population affected, (3) need for preservation of high quality waters, and (4) national priorities.

Two major concepts were considered necessary and sufficient to distinguish any segment from other segments of the basin. These are: (1) the degree of usefulness of the segment, assuming water quality standards are met, and (2) the number of discharges required to meet effluent limitations in order to bring the segment into compliance with water quality standards. These concepts, thus, form the basis of the ranking methodology.

The specific formula used to calculate the total points for a segment is as follows:

$$\text{TOTAL SEGMENT POINTS} = (0.5 + A + B_C + B_W + C + BC + AES + POP) \times SQ$$

Where: A = 2 if the segment contains any designated class A waters and 0 otherwise.

B_c = 2 if the segment contains any designated class B cold waters and 0 otherwise.

B_w = 1 if the segment is designated as a class B warm waters and 0 otherwise.

C = 2 if the segment contains any designated class C waters and 0 otherwise.

BC = 1 if the segment is designated as being useful for either boating and/or canoeing and 0 otherwise.

AES = 1 if the segment is considered to include an area of significant aesthetic value and 0 otherwise.

$$\mathrm{POP} = \begin{bmatrix} 2.0 \\ 1.5 \\ 1.0 \\ 0.5 \\ 0 \end{bmatrix} \text{ if } \begin{bmatrix} 30 \text{ or more} \\ 15 \text{ to } 30 \\ 5 \text{ to } 15 \\ 0.5 \text{ to } 5 \\ 0 \text{ to } 0.5 \end{bmatrix} \text{ thousand people reside}$$

within a 10 mile wide corridor adjacent to either side of the segment and at least one of the above terms (A, B_C, B_w, C, BC, or AES) is nonzero.

SQ = 6 if the segment is designated as water quality limited and more than four dischargers have a waste load allocation more stringent than secondary treatment.

SQ = 5 if the segment is designated as water quality limited and three or four dischargers in the segment have a waste load allocation more stringent than secondary treatment.

SQ = 4 if the segment is designated as water quality limited and one or two dischargers in the segment have a waste load allocation more stringent than secondary treatment.

SQ = 3 if the segment is designated as effluent limited with water quality standards violated.

SQ = 2.5 if the segment is designated as effluent limited with water quality standards met.

SQ = 2 if the pollution load to the segment at low flow is contributed equally by point and nonpoint sources.

SQ = 1 if the pollution load to the segment at low flow is predominantly from nonpoint sources.

The formula for total segment points contains two factors. The first factor allocates points for the degree of usefulness of the segment. It is felt that the population that uses, or would use, the waters of a segment are those most affected by any pollution problems in the segment and further, that this population increases in direct proportion to the potential usefulness of the segment.

The intent of allowing the points of terms A, B_C, B_W, C, BC, and AES, which designate specific water uses, is obvious.

The term POP is included to provide additional points when a segment has any of the above uses, since any usefulness is considered to be of somewhat greater value if a large population resides nearby. The constant term of .5 is included so the product of factors cannot be zero.

The second factor allocates a varying number of points based on whether the segment is designated as effluent limited or water quality limited. The highest level of points is given to segments which have a large number of discharges required to meet waste load allocations more stringent than secondary treatment or BPT to bring the segment into compliance with water quality standards. The scale of points for this factor basically gives an increasing amount of points in those areas where the greatest degree of point source pollution exists.

The total points for a segment are determined from a product of the points earned in each of the two factors. The formula was written in the form of a product so as to give low total points if either factor was low, and high points only if both factors are high. In this manner the formula weighs both the degree of usefulness of a segment and the severity of the pollution problem.

After the total points are determined for each segment in the basin, the segments are then ranked in decreasing order of points. The number one ranked segment is the segment receiving the most total points.

Following the segment ranking, abatement priority points are assigned to each segment. The abatement points are used as a factor in the municipal discharger ranking which is discussed later. The abatement priority points are determined as follows:

ABATEMENT
PRIORITY = Total number of segments + 1 - Segment Rank
POINTS in the basin

The selected stream segments, for the Skunk Basin are detailed in Chapter VI. Total segment points, segment rank, and abatement priority points are also presented in the chapter.

Municipal Discharger Ranking Methodology - In compliance with 40 CFR 130.43, which states that significant municipal dischargers shall be ranked to be subsequently used in establishing priorities and output estimates for municipal facilities construction, the following discharger ranking methodology has been promulgated for the basin plans. This ranking methodology is also in collaboration with current EPA Basin Plan Guidelines (Part IV, para. c) which states that significant municipal dischargers should be ranked in order of abatement priority.

This methodology ranks the municipal discharges in order of significance based on the following criteria:

1. A means of indicating the relative magnitude of one discharger with respect to all other dischargers.
2. A means of accounting for the present effluent quality of the dischargers.

3. A means of indicating the relative magnitude of the discharger in comparison to the capacity of the stream segment at the point of discharge.
4. A means of indicating the relative magnitude of the discharger in comparison to the total waste load of all other dischargers to the stream segment.
5. A means of comparison of the relative merit of the stream segment, to which the municipality discharges, to other segments in the basin.

To incorporate these criteria in the ranking methodology, the following factors were considered and evaluated. It should be noted that the numbering of the factors corresponds to that of the preceeding criteria.

1. Total pounds of BOD_5 and ammonia-N presently being discharged, using average reported flows.
2. Discharger's present BOD_5 and ammonia-N concentrations as reported through EQAP.
3. Discharger's present BOD_5 and ammonia-N waste load compared to the stream capacity.
4. Discharger's present BOD_5 and ammonia-N waste load compared to the total waste load from all dischargers to the stream segment.
5. Stream segment abatement priority points into which the municipality discharges.

Sufficient data is readily available to assess the degree of significance of a municipal discharger in terms of factors

1, 2, and 3. Likewise the stream segment abatement priority points, as indicated in factor 5, have previously been determined, however, the selection and manipulation of required data needed to comply with factor 4 is considerably more difficult due to the non-coincidental cause and effect nature of certain discharged pollutant materials. Thus a blending of factors 3 and 4 was deemed the most feasible alternative. This was accomplished by comparing the discharger's present BOD_5 and ammonia-N waste load to the respective values allowed for the discharger under its waste load allocation. This comparison was felt reasonable and justified since the calculations performed in determining waste load allocations take into account both stream capacities and other discharger's waste loads.

This methodology thus ranks a discharge with respect to its relative share of the waste load to the segment, as well as to the waste load the discharger contributes at its present degree of treatment. This rationale also takes into account population equivalency in lieu of just the contributing population, the relative overloading of the stream segment as determined by waste load allocations analysis, and the relative ranking of the stream segments as determined by the segment ranking methodology.

The specific formula used to rank dischargers is as follows: $(A_1 + D_1) B_1 + (A_2 + D_2) B_2 + C =$ Discharger priority points.

The discharger ranking formula consists of four elements which attempt to incorporate the criteria described above. The four elements are as follows:

Element A: Present Effluent Discharge;

$$A_1 = \begin{bmatrix} 60 \\ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 1 \end{bmatrix} \text{ if the present } BOD_5 = \begin{bmatrix} >60 \text{ mg/l} \\ 60\text{-}50.1 \\ 50\text{-}40.1 \\ 40\text{-}30.1 \\ 30\text{-}20.1 \\ 20\text{-}10.1 \\ 10\text{-}\ 0 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} 60 \\ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 1 \end{bmatrix} \text{ if the present } NH_3\text{-}N = \begin{bmatrix} >40 \text{ mg/l} \\ 40\text{-}30.1 \\ 30\text{-}23.1 \\ 23\text{-}15.1 \\ 15\text{-}\ 8.1 \\ 8\text{-}\ 2.1 \\ 2\text{-}\ 0 \end{bmatrix}$$

This element uses the present average reported BOD_5 and ammonia-N values as representative effluent values, (where possible).

Element B: Degree of stream overloading;

1. BOD Overloading Factor:

$$1 - \frac{\text{lbs. W.L.A.}}{\text{lbs. PRES}} = B_1$$

where: lbs. W.L.A. is the total lbs/day of BOD_5 allowed, as determined by the waste load allocation lb.

lbs. PRES is the average lbs/day of BOD_5 which is currently being discharged.

2. Ammonia-N Overloading Factor:

$$1 - \frac{\text{lbs. W.L.A.}}{\text{lbs. EQAP}} = B_2$$

where: lbs. W.L.A. is the total lbs/day of NH_3-N allowed as determined by the waste load allocations.

lbs. EQAP is the average lbs/day of NH_3-N which is currently being discharged.

Note: B_1 and B_2 are only allowed to vary from zero to 1.00 in this methodology. All other values are set equal to zero.

Element C: The segment abatement priority points are used for element C.

Element D: Total contributing lbs. of BOD_5 and NH_3-N:

$$D_1 = \begin{bmatrix} 0 \\ 1 \\ 3 \\ 5 \\ 7 \\ 9 \\ 12 \\ 14 \\ 16 \\ 18 \\ 21 \\ 25 \end{bmatrix} \quad \text{if the present } BOD_5 = \begin{bmatrix} \text{1.5 or less} \\ 1.5\text{-}\ 3 \\ 3\text{-}\ 5 \\ 5\text{-}\ 10 \\ 10\text{-}\ 20 \\ 20\text{-}\ 50 \\ 50\text{-}\ 100 \\ 100\text{-}\ 250 \\ 250\text{-}\ 750 \\ 750\text{-}1500 \\ 1500\text{-}2500 \\ \text{2500 or more} \end{bmatrix}$$

$$D_2 = \begin{bmatrix} 0 \\ 1 \\ 3 \\ 5 \\ 7 \\ 9 \\ 12 \\ 14 \\ 16 \\ 18 \\ 21 \\ 25 \end{bmatrix} \quad \text{if the present } NH_3\text{-N} = \begin{bmatrix} \text{.75 or less} \\ .75\text{-}\ 1.5 \\ 1.5\text{-}\ 2.5 \\ 2.5\text{-}\ 5 \\ 5\text{-}\ 10 \\ 10\text{-}\ 25 \\ 25\text{-}\ 50 \\ 50\text{-}\ 125 \\ 125\text{-}\ 375 \\ 375\text{-}\ 750 \\ 750\text{-}\ 1250 \\ \text{1250 or more} \end{bmatrix} \quad \text{lbs.}$$

This element takes into account the actual waste load which the stream receives, instead of a representation of the actual population.

The relative position of each discharger is determined by its total points as calculated by the discharger ranking formula. The dischargers are finally ranked in decreasing order of discharger priority points. The ranking of municipal dischargers in the Skunk Basin, as well as the priority points for each discharger, are presented in Chapter VI.

REFERENCES

1. Supporting Document For Iowa Water Quality Management Plans, Iowa Department of Environmental Quality, Water Quality Management Division, Des Moines, Iowa, 1976

CHAPTER II - EXISTING DEVELOPMENT PATTERNS

POLITICAL SUBDIVISIONS

The basin area includes 19 counties or parts thereof. Table II-1 lists those counties, or their respective subdivisions, within the basin. Eighty-seven incorporated communities are included within the basin boundaries. The total 1970 population of these incorporated communities was 178,923. Five of these communities (Ames, Fort Madison, Keokuk, Newton, and Oskaloosa) have populations greater than 10,000 and account for 54 percent of the incorporated population, while 64 communities have populations less than 1,000 and account for only 15 percent. There are 8 communities with populations between 1,000 and 5,000, and 5 communities with populations between 5,000 and 10,000 accounting for 10 and 21 percent, respectively, of the incorporated populations. Figure II-1 shows the incorporated municipalities in the basin and Table II-2 summaries their 1970 populations.

POPULATION PROJECTION

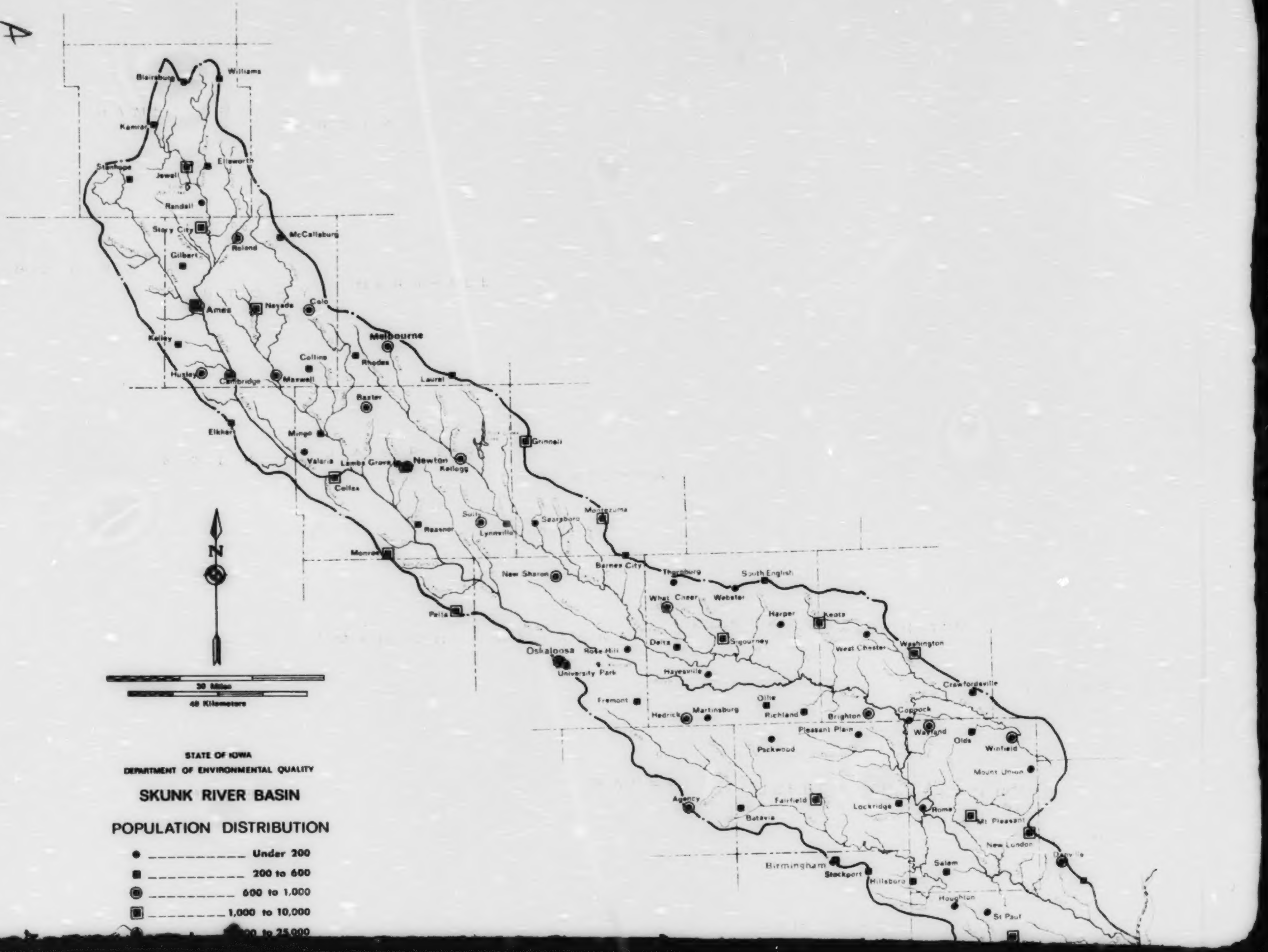
The Department of Environmental Quality has made 1990 population projections for those cities in the basin, based on the projections of Taylor (1). For those individual municipal projections not estimated by Taylor, the 1990 population of the community was estimated by multiplying its 1970 population by the ratio of the projected 1990 county population to the 1970 county population. The 1990 population projections used for this study are indicated in Table II-2.

TABLE II-1

PORTION OF COUNTIES WITHIN THE SKUNK RIVER BASIN

County	Percent	County	Percent
Boone	22	Mahaska	67
Des Moines	17	Marion	11
Hamilton	61	Marshall	16
Hardin	3	Polk	21
Henry	99	Poweshiek	20
Jasper	90	Story	84
Jefferson	90	Van Buren	10
Keokuk	81	Wapello	40
Lee	66	Washington	47
Louisa	1		

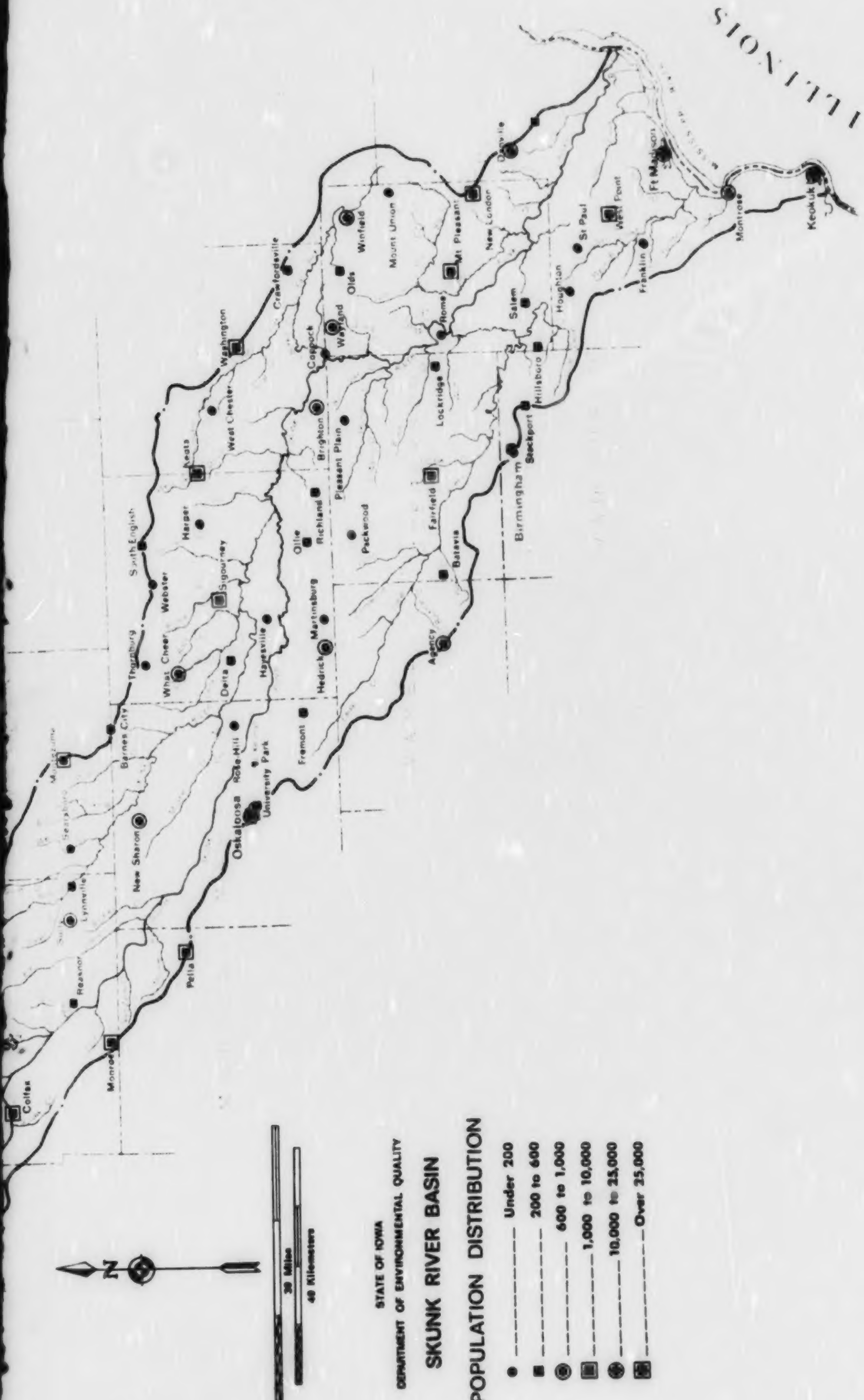
A


Blairsburg
Williams
Kamrar
Stanhope
Jewell
Ellsworth
Randall
Story City
Roland
McCallsburg
Gilbert
Ames
Nevada
Colo
Melbourne
Kelley
Collins
Rhodes
Huxley
Cambridge
Maxwell
Laurel
Baxter
Elkhart
Mingo
Grinnell
Valeria
Lambs Grove
Newton
Kellogg
Colfax
Sully
Lynnville
Searsboro
Montezuma
Reasnor
Monroe
New Sharon
Barnes City
Thornburg
South English
What Cheer
Webster
Harper
Keota
Pella
Delta
Sigourney
West Chester
Washington
Oskaloosa
Rose Hill
University Park
Hayesville
Crawfordsville
Fremont
Ollie
Richland
Hedrick
Martinsburg
Brighton
Coppock
Wayland
Olds
Winfield
Pleasant Plain
Packwood
Mount Union
Agency
Batavia
Fairfield
Lockridge
Rome
Mt Pleasant
New London
Birmingham
Stockport
Salem
Danville
Hillsboro
Houghton
St Paul
N
30 Miles
48 Kilometers
● Under 200
■ 200 to 600
◉ 600 to 1,000
▣ 1,000 to 10,000
00 to 25,000

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SKUNK RIVER BASIN

POPULATION DISTRIBUTION


ILLINOIS
Keokuk
Montrose
Ft Madison
West Point
St Paul
Franklin
Houghton
Danville
New London
Mt Pleasant
Mount Union
Winfield
Olds
Crawfordsville
Salem
Rome
Wayland
Coppock
Washington
Hillsboro
Lockridge
Stockport
Birmingham
West Chester
Brighton
Pleasant Plain
Keota
Fairfield
Harger
Richland
Packwood
Ollie
South English
Sigourney
Batavia
Webster
Martinsburg
Hayesville
Hedrick
Thornburg
What Cheer
Delta
Agency
Barnes City
Fremont
Rose Hill
University Park
Oskaloosa
New Sharon
Montezuma
Searsboro
Lynnville
Reasnor
Pella
Monroe
Colfax
N
20 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SKUNK RIVER BASIN
POPULATION DISTRIBUTION
Under 200
200 to 600
600 to 1,000
1,000 to 10,000
10,000 to 25,000
Over 25,000

B

FIGURE II-1

TABLE II-2

EXISTING AND PROJECTED POPULATIONS (AFTER TAYLOR (1))

Town	County	Pop. 1970	Pop. 1990
Agency	Wapello	610	763
Ames	Story	39,505	76,185
Barnes City	Poweshiek	238	243
Batavia	Jefferson	525	614
Baxter	Jasper	788	955
Birmingham	Van Buren	452	465
Blairsburg	Hamilton	287	296
Brighton	Washington	632	711
Cambridge	Story	661	960
Colfax	Jasper	2,293	2,779
Collins	Story	404	587
Colo	Story	606	880
Coppock	Washington	58	65
Crawfordsville	Washington	288	324
Danville	Des Moines	948	1,464
Delta	Keokuk	475	499
Elkhart	Polk	269	353
Ellsworth	Hamilton	443	457
Fairfield	Jefferson	8,715	10,875
Fort Madison	Lee	13,996	14,896
Franklin	Lee	111	156
Fremont	Mahaska	480	493
Gilbert	Story	521	757
Grinnell	Poweshiek	8,402	11,553
Harper	Keokuk	405	426
Hayesville	Keokuk	93	98
Hedrick	Keokuk	790	830
Hillsboro	Henry	252	320
Houghton	Lee	119	167
Huxley	Story	1,377	2,001
Jewell	Hamilton	1,152	1,188
Kamrar	Hamilton	243	251
Kelley	Story	235	341
Kellogg	Jasper	607	756
Keokuk	Lee	14,631	15,107
Keomah	Mahaska	58	62
Keota	Keokuk	707	743
Lambs Grove	Jasper	239	290

TABLE II-2 (cont.)

EXISTING AND PROJECTED POPULATIONS

Town	County	Pop. 1970	Pop. 1990
Laurel	Marshall	245	320
Lockridge	Jefferson	232	271
Lynnville	Jasper	381	462
Martinsburg	Keokuk	140	147
Maxwell	Story	758	1,101
McCallsburg	Story	307	446
Melbourne	Marshall	661	863
Mingo	Jasper	260	315
Monroe	Jasper	1,389	1,683
Montezuma	Poweshiek	1,353	1,381
Montrose	Lee	735	1,030
Mt. Pleasant	Henry	7,007	7,852
Mt. Union	Henry	173	219
Nevada	Story	4,952	8,737
New London	Henry	1,900	2,413
New Sharon	Mahaska	944	969
Newton	Jasper	15,619	19,464
Olds	Henry	206	262
Ollie	Keokuk	268	282
Oskaloosa	Mahaska	11,224	13,575
Packwood	Jefferson	157	183
Pella	Marion	6,668	11,001
Pleasant Plain	Jefferson	121	141
Randall	Hamilton	179	185
Reasnor	Jasper	284	344
Rhodes	Marshall	347	453
Richland	Keokuk	595	625
Roland	Story	803	1,167
Rome	Henry	135	171
Rose Hill	Mahaska	192	197
Salem	Henry	458	582
Searsboro	Poweshiek	140	143
Sigourney	Keokuk	2,319	2,437
South English	Keokuk	218	229
Stanhope	Hamilton	482	497
Stockport	Van Buren	334	344

TABLE II-2 (cont.)

EXISTING AND PROJECTED POPULATIONS

Town	County	Pop. 1970	Pop. 1990
Story City	Story	2,104	3,057
Sully	Jasper	685	830
Thornburg	Keokuk	98	103
University Park	Mahaska	534	548
Valeria	Jasper	96	116
Washington	Washington	6,317	8,133
Wayland	Henry	702	892
Webster	Keokuk	130	137
West Chester	Washington	199	224
West Point	Lee	1,045	1,464
What Cheer	Keokuk	868	912
Williams	Hamilton	456	470
Winfield	Henry	897	1,139

ECONOMICS

A brief economic profile for the Skunk River Basin is given in Table II-3.

Personal Income

Within the period from 1960 to 2000, personal per capita income is expected to more than double, increasing from $1925 to $5334 (2). This rate of increase is still about 12% lower than the projected national average (5). Personal per capita income in the basin should thus move farther from the national average, decreasing from approximately 20 to approximately 34 percent less.

Employment

Within the period from 1960 to 2000, civilian employment in the basin is expected to almost double, increasing from 83 to 159 thousand (2). This rate of increase is about eight percent greater than the projected national average (5).

Employment in agriculture, once the largest employer in the basin, is projected to decline while industrial employment will increase.

RECREATIONAL ACTIVITIES

The Skunk River Basin provides numerous water-related recreational activities. The following areas are suitable for recreational sites.

TABLE II-3

ECONOMIC PROFILE OF THE SKUNK RIVER BASIN (2)

	Population, thousand			Personal Income	
	Total	Nonfarm	Farm	Total Income	Per Capita Income
				1960 Dollars(Million)	Dollars
1960	222	169	53	427	1,925
1980	286	250	36	955	3,338
2000	392	364	28	2,040	5,334
2020	545	523	22	4,586	8,418

	Employment, thousand				
Year	Total	Noncommodity Producing[a]	Commodity Producing[b]	Manufacturing Commodities	Nonmanufacturing Commodities
1960	83	43	40	23	17
1980	117	68	49	35	14
2000	159	100	59	47	12
2020	218	146	72	62	10

	Employment for Selected Manufacturing Industries by SIC[d], thousand						
Year	20 Food	28 Chem	29 Petrol Prod	32 Stone, Clay, Glass	33 Primary Metals	34, 35 Fabr Met & Nonelec Mach	Total
1960	2	(c)	(c)	(c)	1	3	6
1980	2	(c)	(c)	(c)	1	3	6
2000	2	(c)	(c)	(c)	1	3	6

	Output (Value Added) for Selected Manufacturing Industries by SIC, million 1960 dollars						
Year	20 Food	28 Chem	291 Petrol Ref	324 Hyd Cemt	33 Primary Metals	34, 35 Fabr Met & Nonelec Mach	Total
1960	19	5	-	-	4	34	62
1980	43	12	-	-	7	63	125

---

[a] Noncommodity group includes the following SIC categories: 15-17 Construction; 40-49 Transportation, Communications, and Public Utilities; 50 Wholesale Trade; 52-59 Retail Trade; 60-67 Finance, Insurance and Real Estate; 70-89 Services; and 91-93 Government.

[b] Commodity group includes SIC categories: 01-09 Agriculture; 10-14 Mining; 19 Ordnance; 20 Food; 21 Tobacco; 22 Textiles; 23 Apparel; 24 Lumber; 25 Furniture; 26 Pulp and Paper; 27 Printing and Publishing; 28 Chemicals; 29 Petroleum Products; 30 Rubber and Plastics; 31 Leather Products; 32 Stone, Clay, and Glass; 33 Primary Metals; 34 Fabriciated Metals; 35 Nonelectrical Machinery; 36 Electrical Equipment; 37 Transportation Equipment; 38 Instruments; and 39 Miscellaneous Manufacturing and Other Manufacturing.

[c] Less than 500 employees.

[d] Standard Industrial Classification

1. Hills with trees for nature observation, hiking, and camping.

2. Lakes or streams for swimming, boating, waterskiing, and fishing.

3. Flood plains and plateaus for organized sport activities.

4. A combination of the above as a game habitat.

A common element of all available county and city plans reviewed for the study was the concept of retaining land along rivers for conservancy belts. These are to be left in a natural state for recreational pursuits, such as hiking, and stream access.

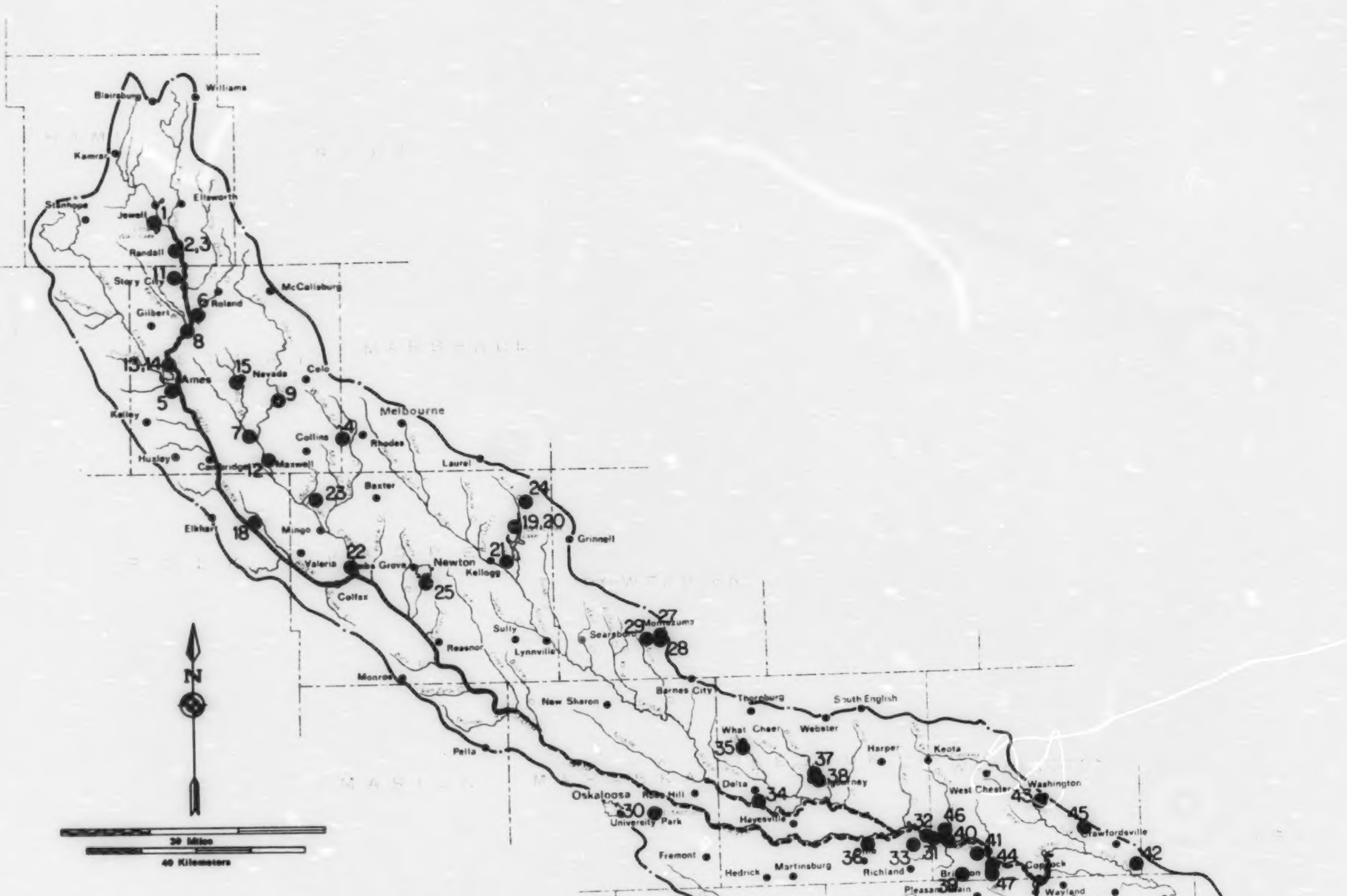
From a recreational standpoint, water must be of sufficient quality to support the propagation of desirable forms of fish and wildlife. Iowa "Class B" warm water standards should be adequate to satisfy this requirement (see Chapter II, Supporting Document). In areas where human body contact with the water is permitted, "Class A" standards are required for public health reasons. Maintenance of either Class A or Class B standards are required to retain an aesthetically acceptable water condition.

Figure II-2 shows the location of areas for boating activities in the Skunk River Basin. Total or partial body contact with water would probably occur in areas not specifically designated. For example, body contact would generally occur in the canoeing regions. However, only those areas designated as body contact area need to meet Class A standards.

Figure II-2 also shows the location of existing and proposed recreational sites in the river basin. Table II-4 lists data relative to each site. Average peak daily attendance at parks was assumed to be 3 percent of the total yearly attendance. Total yearly attendance figures were obtained from state and county parks records, when available, or from estimates by park personnel. All wildlife areas were assumed to have less than 500 persons per peak day.

High user densities at specific recreation sites along the Skunk River and at certain lakes can impart a high pollution load on the nearby groundwater and surface water unless wastes are satisfactorily handled. Although many of the lakes are at present lightly developed, intense development will increase pollution potential. Proper planning of recreational and wastewater handling facilities would control the adverse impact upon water quality.

A


N
30 Miles
40 Kilometers
Recreational Site
Canoeing
Power Boats Under 10 HP
Power Boats Over 10 HP
Blairsburg
Williams
Kamrar
Stanhope
Jewell
Ellsworth
Randall
Story City
McCallsburg
Roland
Gilbert
Ames
Nevada
Colo
Kelley
Huxley
Cambridge
Collins
Rhodes
Maxwell
Melbourne
Laurel
Baxter
Elkhart
Mingo
Valeria
Colfax
Newton
Kellogg
Grinnell
Sully
Lynnville
Reasnor
Searsboro
Montezuma
Monroe
Barnes City
New Sharon
Thornburg
South English
Pella
What Cheer
Webster
Harper
Keota
Delta
Oskaloosa
Rose Hill
University Park
Hayesville
Fremont
Hedrick
Martinsburg
Richland
West Chester
Washington
Crawfordsville
Brighton
Pleasant Plain
Coppock
Wayland
Olds
Winfield
Packwood
Mount Union
Fairfield
Lockridge
Agency
Batavia
Mt Pleasant
New London
Birmingham
Stockport
Salem
Danville
Hillsboro
Houghton
St Paul
West Point
Franklin
Ft Madison
1
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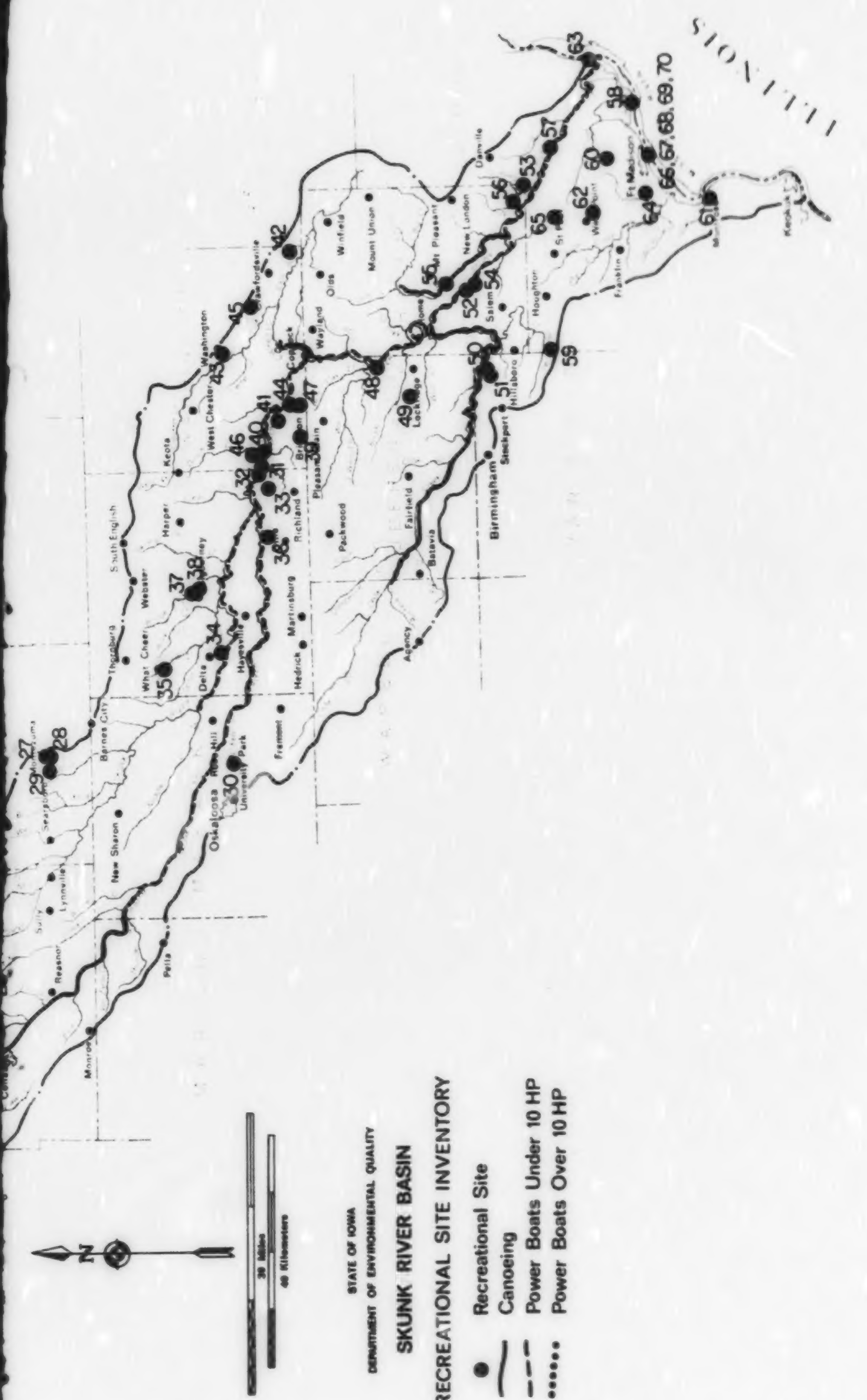
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SKUNK RIVER BASIN

RECREATIONAL SITE INVENTORY


STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SKUNK RIVER BASIN
RECREATIONAL SITE INVENTORY
● Recreational Site
Canoeing
Power Boats Under 10 HP
Power Boats Over 10 HP
N
20 Miles
40 Kilometers
ILLINOIS
Oskaloosa
Pella
Monroe
New Sharon
Washington
Fairfield
Mt Pleasant
New London
Burlington
Ft Madison
Keokuk
Birmingham
Stockport
Richland
Packwood
Martinsburg
Hedrick
Fremont
Sigourney
Delta
Harper
Keota
West Chester
Crawfordsville
Wayland
Olds
Winfield
Mount Union
Danville
Salem
Houghton
Franklin
Hillsboro
Lockridge
Batavia
Agency
Brighton
Coppock
Rome
Thornburg
Webster
South English
What Cheer
Barnes City
Hayesville
University Park
Rose Hill
Lynnville
Sully
Reasnor
Searsboro
Montezuma
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66,67,68,69,70

B FIGURE II-2

TABLE II-4

EXISTING AND PROPOSED RECREATION FACILITIES

SKUNK RIVER BASIN

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
1	Little Wall Lake	County		61	61			●	●	●	●			●	●	●
2	Riverside Lutheran Bible Camp	Private		40	40											
3	Boy Scout Camp	Private														
4	Hendrickson Marsh	State		601	533	70								●		
5	State Forest Nursery	State		97	97											
6	McFarland Park	County		93	85	8					●					
7	Robinson's Access	County		58	58											
8	Soper's Mill Access	County		18	16	2					●			●	●	
9	Hickory Grove Park	County		368	258	110				●	●			●	●	●
10	Twin Anchors	Private		69	60	9				●	●				●	
11	Whispering Oaks KOA	Private		13	13					●						
12	Izaak Walton League	Private		40	40											
13	Izaak Walton League	Private		50	45	5										
14	YMCA Woods	Private		18	18											
15	Wes McDaniels Camp	Private		50	30	20										
16	Campfire Girls Camp	Private		2	2											
17	Arnolds Lake	Private		83	80	3										
18	Chicaqua Wildlife Area	County		1161	1136	25				●	●			●		
19	Rock Creek State Park	State	5	1213	613	600		●	●	●	●				●	●
20	Rock Creek Game Area	State	5	435	312	123					●			●		
21	Kellogg Area	State		66	61	5								●		
22	Colfax Area	State		350	275	75								●		
23	Ashton Wildwood Park	County		98	98					●			●	●	●	
24	Mariposa Area	County		111	93	18				●	●		●		●	
25	Newton KOA	Private		25	25					●						
26	Arbor Lake County Park	County		37	37											
27	Diamond Lake	County		176	46	130	●	●	●	●						
28	Fox Forest Area	County		230	230									●		

TABLE II-4

EXISTING AND PROPOSED RECREATION FACILITIES

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
	SKUNK RIVER BASIN															
29	Lake Ponderosa	Private		1020	897	123		●	●	●	●		●			●
30	Lake Keomah State Park	State	3	366	286	80		●	●	●	●		●		●	●
31	Rubio Access	State		134	134						●			●		
32	Skunk River Access	State		425	425						●			●		
33	Bond Hill Area	County		8	8										●	
34	Delta Covered Bridge	County		1	1						●				●	
35	Griffin Park	County		40	40					●	●		●		●	
36	Manhattan Bridge	County		1	1			●	●	●	●				●	
37	Yen - Ruo - Gis Park	County		76	68	8				●	●				●	●
38	Izaak Walton League	Private														
39	Lake Darling	State	4	1387	1085	302		●	●	●	●				●	●
40	McKane Access	State		10	7	3		●	●		●			●		
41	Brinton Forest Area	County														
42	Ferne Cliff Area	County		40	38	2		●	●	●	●		●	●	●	
43	Hayes Timber	County		34	34								●		●	
44	Hwy. No. 1 Skunk River Access	County		1	1						●			●		
45	Sockum Ridge Park	County		80	79	1				●			●	●	●	
46	Valley Wildlife Area	County		1	1									●		
47	Izaak Walton League	Private														
48	MacCoom Area	State		71	71				●	●		●			●	
49	Woodthrush Preserve	State		25	25									●		
50	Morris Memorial Park	County		30	30						●		●		●	
51	Morris Park	Private		20	19	1									●	
52	Oakland Mills Access	State		27	27					●	●			●		
53	Geode State Park	State	6	1651	1438			●	●	●	●		●		●	
54	Oakland Mills Recreation Area	State		91	91			●	●	●	●		●		●	
55	Big Creek Park	County	1	27	27											
56	Mud Creek Park	County		52	52											

TABLE II-4

EXISTING AND PROPOSED RECREATION FACILITIES

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES			MAJOR ACTIVITIES									
				TOTAL AREA	LAND AREA	WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
	SKUNK RIVER BASIN															
57	Skunk River Access	State		86	86			●	●	●	●		●	●	●	
58	Green Bay Lake	State		228	205	23								●		
59	Coleman Memorial Park	County		3	3											
60	Werner Memorial Woods	County		44	44											
61	Riverview Park	County		2	2			●	●		●				●	
62	Pollmiller Park	County		75	75											
63	Skunk River Access	County		1	1						●					
64	Devils Creek Access	County		1	1						●					
65	Wilderness Camp	Private		190	190			●	●	●	●			●	●	
66	Spring Lake	Private														
67	Riverview Boat Harbor	Private														
68	McNeeley's 20th Street Harbor	Private														
69	Izaak Walton League	Private														
70	Ft. Madison Campfire Girl	Private														

*APPROXIMATE PROBABLE USAGE

Visitors Per Average Peak Day	Usage Class
0-500	1
501-1,000	2
1,001-5,000	3
5,001-10,000	4
10,001-15,000	5
Over-15,000	6

REFERENCES

1. *J. R. Taylor, Provisional Projections of the Population of Iowa Counties and Cities: 1975 to 1990*, Iowa State Department of Health, June 1972.

2. *Upper Mississippi River Comprehensive Basin Study* VIII, appendix P: Economic Base Study and Projections, prepared by the Economic Advisory Committee, Upper Mississippi River Basin Coordinating Committee, 1970.

3. *Outdoor Recreation in Iowa* vol. V(b), Iowa Outdoor Recreation Guide, prepared by Planning and Coordination Section, Iowa Conservation Commission, July, 1972.

4. *The Quality of Life in Iowa: An Economic and Social Report to the Governor for 1972*, prepared by the Office For Planning and Programming, April 1972.

5. *1972 OBERS Projections, Regional Economic Activity in the U.S.*, vol. I, Concepts, Methodology, and Summary Data, U.S. Water Resources Council, April, 1974.

CHAPTER III - BASIN CHARACTERISTICS

The Skunk River Basin extends from near the center of the state to the Mississippi River in southeastern Iowa (Figure III-1). It is bounded on the northeast by the Iowa-Cedar River Basin and on the west and southwest by the Des Moines River Basin. The basin is long and narrow having an overall length of 180 miles, a maximum width of almost 40 miles, and an average width of 24 miles. The total drainage area of the basin is 4,355 square miles, or 7.7 percent of the total land area of the state, and it includes parts of 20 counties.

The Skunk River begins in Hamilton County and flows in a generally southeast direction into the Mississippi River about 10 miles downstream from Burlington, Iowa. The largest tributary stream is the North Skunk River which has a drainage area of 869 square miles and joins the Skunk River in Keokuk County. Other tributaries having drainage areas in excess of 200 square miles are Cedar Creek, Crooked Creek, Indian Creek, and Squaw Creek. The drainage areas at selected points within the basin are listed in Table III-1.

The Fort Madison-Keokuk area, drained by the Mississippi River and small tributaries, has been included as part of the Skunk River Basin to be consistent with Iowa Conservancy District boundaries, Figure III-1. The area is an approximately triangular tract bounded on the east by the Mississippi River and on the other two sides by the drainage

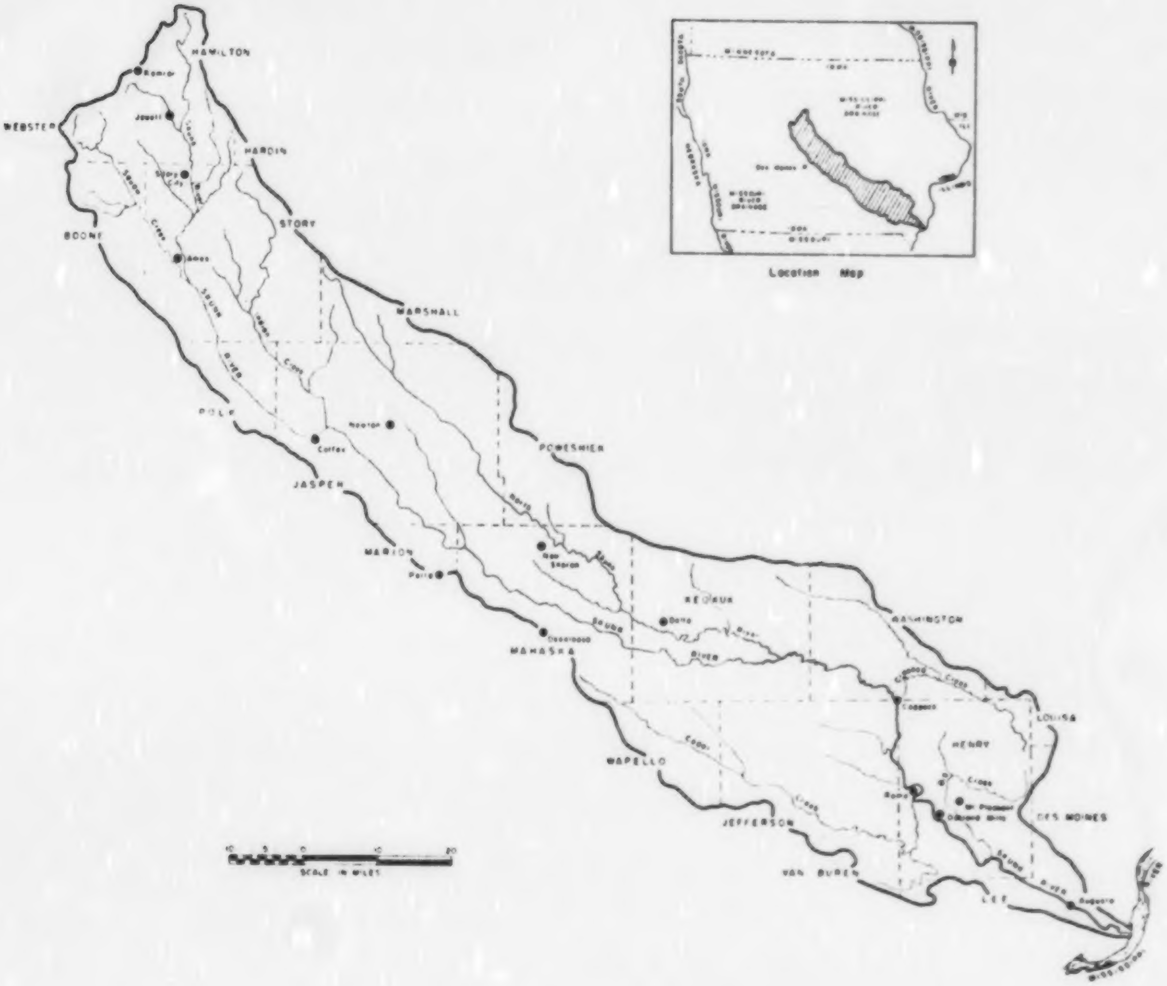

HAMILTON
WEBSTER
HARDIN
BOONE
STORY
Ames
Story City
Jewell
MARSHALL
POLK
Colfax
Newton
POWESHIEK
JASPER
MARION
Pella
New Sharon
KEOKUK
WASHINGTON
MAHASKA
Skunk River
Coppock
LOUISA
HENRY
WAPELLO
Mt Pleasant
DES MOINES
JEFFERSON
VAN BUREN
LEE
Augusta
Mississippi
SCALE IN MILES
10
0
10
20
Location Map

FIGURE III-1 SKUNK RIVER BASIN

TABLE III-1

DRAINAGE AREAS AT SELECTED POINTS IN THE SKUNK RIVER BASIN

	Distance from Mississippi River, Miles (1)	Drainage Area Square Mile (2)
SKUNK RIVER		
Junction with Mississippi Riv.	0	4,355
USGS gage at Augusta	12.2	4,303
Below junction with Big Creek	26.8	4,225
Above junction with Big Creek	26.8	4,058
Below junction with Cedar Creek	43.1	3,990
Above junction with Cedar Creek	43.1	3,425
Below junction with Crooked Creek	66.4	3,202
Above junction with Crooked Creek	66.4	2,916
Discontinued USGS gage near Coppock	66.6	2,916
Below junction with North Skunk Riv.	93.1	2,709
Above junction with North Skunk Riv.	93.1	1,840
USGS gage near Oskaloosa	138.6	1,635
Below junction with Indian Creek	179.5	1,220
Above junction with Indian Creek	179.5	807
USGS gage below junction with Squaw Creek near Ames	213.3	556
Above junction with Squaw Creek	213.3	329
USGS gage near Ames	219.0	315
TRIBUTARIES		
Big Creek at mouth	26.8	167
Big Creek USGS gage near Mt. Pleasant		106
Cedar Creek at mouth	43.1	565
Crooked Creek at mouth	66.4	286
North Skunk River at mouth	93.1	869
North Skunk River USGS gage near Sigourney	104.1	730
Indian Creek at mouth	179.5	413
Squaw Creek at mouth	213.3	227
Discontinued Squaw Creek USGS gage at Ames	216.9	204

(1) U.S. Army, Corps of Engineers, 1951, Review Report for Flood Control, Skunk River, Iowa (Not Published).
(2) Drainage Areas of Iowa Streams, 1957, U.S. Geological Survey.

divides of the Skunk and Des Moines River Basins. The Fort Madison-Keokuk area includes 270 square miles of land and drains part of Lee County into the Mississippi River.

LAKES AND IMPOUNDMENTS

The Skunk River Basin has no major artificial impoundments. The basin contains 16 small lakes or impoundments, ranging in size from 1 to 600 acres surface area. Of these, 8 are designated as class A, 16 as class B, and 5 as class C (See Chapter IV on water quality classifications). The lakes are listed in Table III-2.

PHYSIOGRAPHIC FEATURES (1)

Glacial activity and subsequent periods of erosion within comparatively recent geologic time have determined the present physiographic conformation of the Skunk River Basin. The old eroded bedrock surface was modified by the advance and retreat of four great glaciers, the Nebraskan, Kansan, Illinoian, and Wisconsin, which covered all or part of the area, (Figure III-2). The Nebraskan is believed to have covered all of Iowa, but its drift is deeply buried beneath later glacial debris and is exposed in only a few areas where extensive erosion has occurred. The Kansan also covered the entire basin, but its drift is presently exposed only in the middle and part of the lower portions of the basin which the Illinoian and Wisconsin ice sheets did not reach. Four substages of the Wisconsin are recognized in

Table III-2

SKUNK RIVER BASIN
LAKES AND IMPOUNDMENTS

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water	Surface Water Classification A	B	C
Little Wall Lake	Hamilton	273	24-86-10	State	NL	X	X	
Geode Lake	Henry	205	5-70-36	State	OSI	X	X	X
Oak Mill Impoundment	Henry		6-71-30	State	OnSI	X	X	
Mariposa Lake	Jasper	26	18-81-32	C.C.B.	OSI		X	
Rock Creek Lake	Jasper	600	17-80-17	State	OSI	X	X	
Fairfield Reservoir	Jefferson	142	10-72-24	City	OSI		X	X
Walton Reservoir	Jefferson		9-72-19				X	X
Griffin Lake	Keokuk	20	13-76-15	C.C.B.	GP		X	
Yenrougis	Keokuk	10	12-76-23	C.C.B.	GP		X	
Poll Miller Park	Lee	16	5-68-9	C.C.B.	OSI		X	
Wilson Lake	Lee	8	6-68-35	C.C.B.	OSI		X	
Lake Keomah	Mahaska	82	15-75-13	State	OSI	X	X	
Diamond Lake	Poweshiek	130	15-78-2	C.C.B.	OSI	X	X	X

Table III-2 (Continued)

SKUNK RIVER BASIN
LAKES AND IMPOUNDMENTS

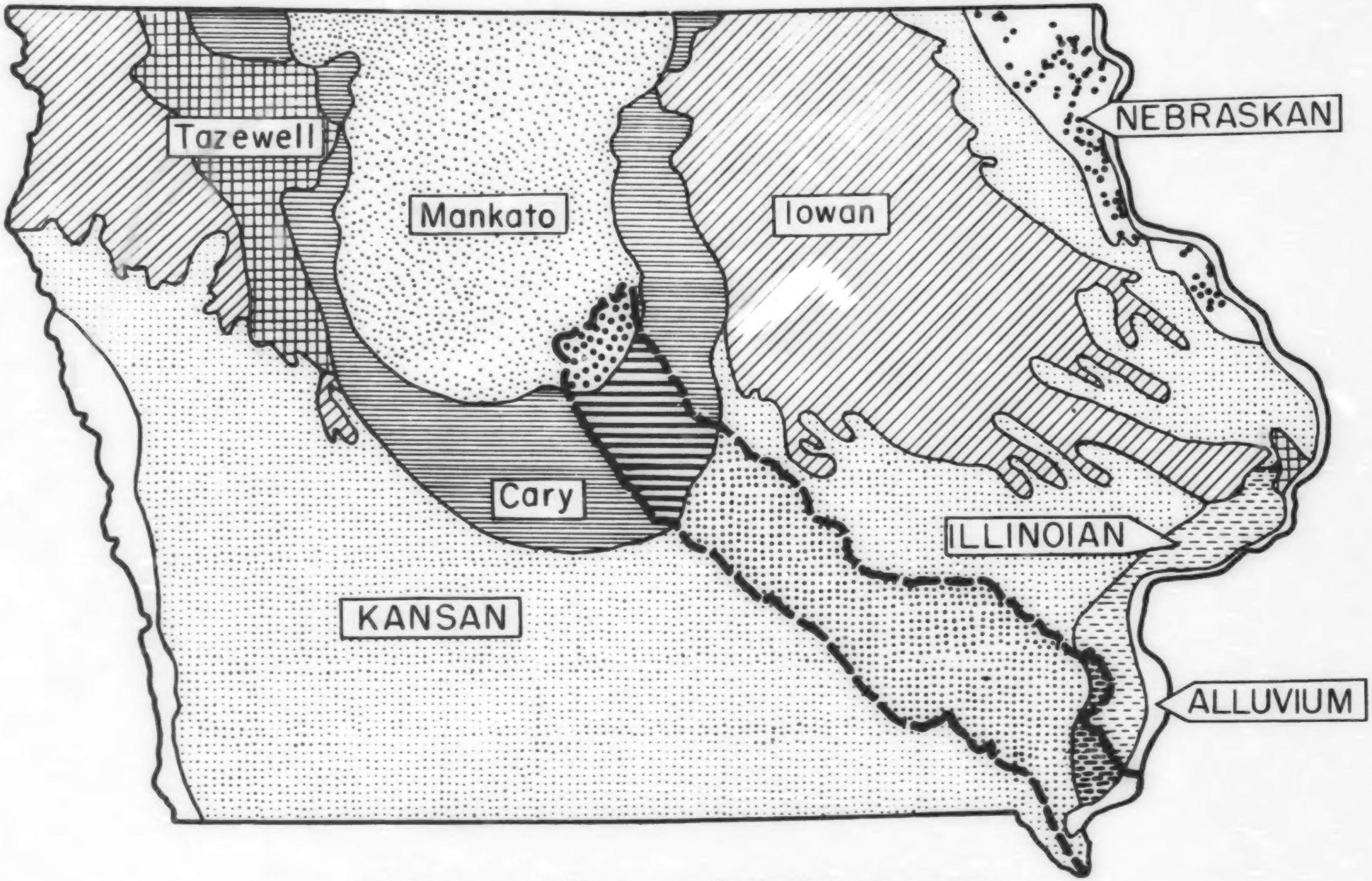
Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water	Surface Water Classification		
						A	B	C
Hickory Grove Lake	Story	110	22-83-23	C.C.B.	OSI	X	X	
McFarlands Pond	Story	8	23-84-7	C.C.B.	OSI		X	
Lake Darling	Washington	302	9-74-21	State	OSI	X	X	X

*Range-Township-Section

Type of Water -

FP--- Farm Pond
GP--- Gravel Pit
NL--- Natural Lake
OnSI- On Stream Impoundment
OSI-- Off Stream Impoundment

FIGURE III-2
GLACIAL GEOLOGY OF IOWA (1)


Tazewell
Mankato
Iowan
NEBRASKAN
Cary
ILLINOIAN
KANSAN
ALLUVIUM

The Wisconsin Drift is comprised of the four areas designated as Tazewell, Mankato, Cary, and Iowan.

Iowa, but surface drifts from only two of them, the Cary and Mankato, are present in the basin.

Each glacial advance was separated from the preceding one by a long interglacial stage during which the ground surface was changed by weathering and erosion. In the case of the Nebraskan, Kansan, and Illinoian drifts this time was sufficient for the formation of a deeply weathered zone, called "gumbotil," and permitted the development of rather complete surface drainage systems. In the case of the Wisconsin drift, however, the advance and retreat has been so recent that no such extensive weathering has taken place, and a complete drainage system has not developed. Therefore, the Skunk River Basin is divided into an area of youthful topography in that region covered by the Wisconsin drift and an area of more mature topography in which the river and its tributaries has caused extensive erosion of the older drifts and the bedrock beneath them.

The late Wisconsin drift area is characterized by areas of ground moraine which are nearly level to gently undulating and areas of terminal and recessional moraine with a more marked relief which bears little relation to the general drainage pattern. The streams are in a youthful stage of development, and only a comparatively small part of the drift plain has adequate drainage. Broad areas of undrained land remain between the upper ends of existing natural drainageways. These areas were formerly lakes and swamps which have now been drained by tile and open ditches to make the rich land suitable for cultivation. In spite of the extensive drainage program, however, the land ponds badly during periods of excessive rainfall.

In the river basin downstream from the Wisconsin drift area an abrupt topographic change takes place. The streams are in a mature stage, their flood plains are large and well developed, and the uplands are for the most part well drained. In this region the topography is the evident result of a much longer period of development than has taken place on the Wisconsin drift. The Kansan drift plain is not completely dissected in the Skunk River Basin and is preserved along a considerable portion of the watershed in flat, tabular divides which are well drained by headworking streams having rather deep valleys as they leave the uplands. Although the Illinoian drift is younger, its topography is very similar to that of the Kansan.

During the retreat of the Iowan glacier from the area north and east of the Skunk River Basin, and shortly thereafter during the interglacial substage, wind-blown loess was deposited on the Kansan and Illinoian till plains of the basin. The loess mantle is thickest in Jasper and Marshall Counties where it exceeds depths of 18 feet. The deposits become progressively thinner toward the southeast, having a maximum of 9 to 18 feet in the middle basin and from 6 to 9 feet in the lower basin. The loess has been almost completely removed from the steeper slopes of the basin especially in the lower portions where the original covering was thin.

In Hamilton County and part of Story County the Skunk River flows in a youthful and comparatively narrow valley of shallow to moderate depth. In Story County the valley becomes gorge-like with sandstone, shale, and limestone outcroppings along its sides. Immediately above Ames the valley widens rapidly as the river enters a preglacial channel. Below Ames in Story, Polk, Jasper, and Marion Counties the Skunk River occupies a wide and fertile plain having a maximum width of about 2 miles in Polk County. This portion of the originally winding channel has been straightened from near Ames through Mahaska County. The valley bottoms are moderately wide in Mahaska County but are somewhat narrower through Keokuk, Washington, Jefferson, and Henry Counties. The river is very sinuous in Keokuk county, but becomes progressively less so downstream. Near Rome, in Henry county, the river enters a postglacial valley and the bottoms are about a quarter of a mile in width. Bedrock is exposed in the bed of the stream and along the valley sides. This gorge continues to below Augusta where the valley becomes wide again and merges with the flood plain of the Mississippi River. Stream slopes in the upper reaches of the Skunk River are moderate to low and tend to decrease on downstream (Table III-3).

Along the North Skunk River the alluvial bottoms are narrow, to about one mile in width. The channel through most of Jasper County has been artificially straightened, but the remainder of the river winds through the flood plain and becomes extremely sinuous through most of Keokuk County.

TABLE III-3

AVERAGE SLOPES IN VARIOUS REACHES OF THE SKUNK RIVER AND NORTH SKUNK RIVER (1)

From	To	Average Slope in Ft. Per Mi.
Skunk River		
Kamrar	Story City	7.8
Story City	Ames (Junction Squaw Creek)	5.0
Ames	Colfax	2.9
Colfax	Pella	2.1
Pella	Oskaloosa	1.4
Oskaloosa	Mahaska-Keokuk County Line	2.1
Mahaska-Keokuk County Line	Coppock	1.3
Coppock	Oakland Mills	1.3
Oakland Mills	Mississippi Backwater	1.1
North Skunk River		
Poweshiek-Mahaska County Line	Union Mills (Near New Sharon	3.0
Union Mills	Delta	2.3
Delta	Mouth	1.9

Valleys of Cedar Creek, Crooked Creek, Indian Creek, Squaw Creek, and other major tributaries are generally narrow, but relatively wide flood plains occur on some lower portions of Cedar Creek and Indian Creek.

The flood plain of the Skunk River in Polk, Jasper, Marion, and parts of Mahaska and Story Counties is frequently flooded except where levee protection has been provided. Extensive drainage has converted much of the heavy soil of these bogs to fertile farmland, and channel straightening and leveeing have reduced the dangers of flooding. Channelization has also led to a reduction of fish and wildlife habitats.

NATURAL RESOURCES (1)

Soil and water are the principal natural resources, found in the Skunk River Basin. Forests and mineral resources, such as gravel, clay, and coal, are of importance in local areas where they have been developed, but soil is undoubtedly the most important single resource in this predominantly agricultural basin.

Soils

A great variety of soils are found in the basin. They result from differences in the parent materials, topography, vegetation, and climate, and the extent to which time has permitted modification. The soils have been grouped into association areas which indicate the usual arrangement of soil types and topography giving rise to a characteristic landscape within an individual area. The principal soil association areas of the Skunk River Basin are shown in Figure II-3 and

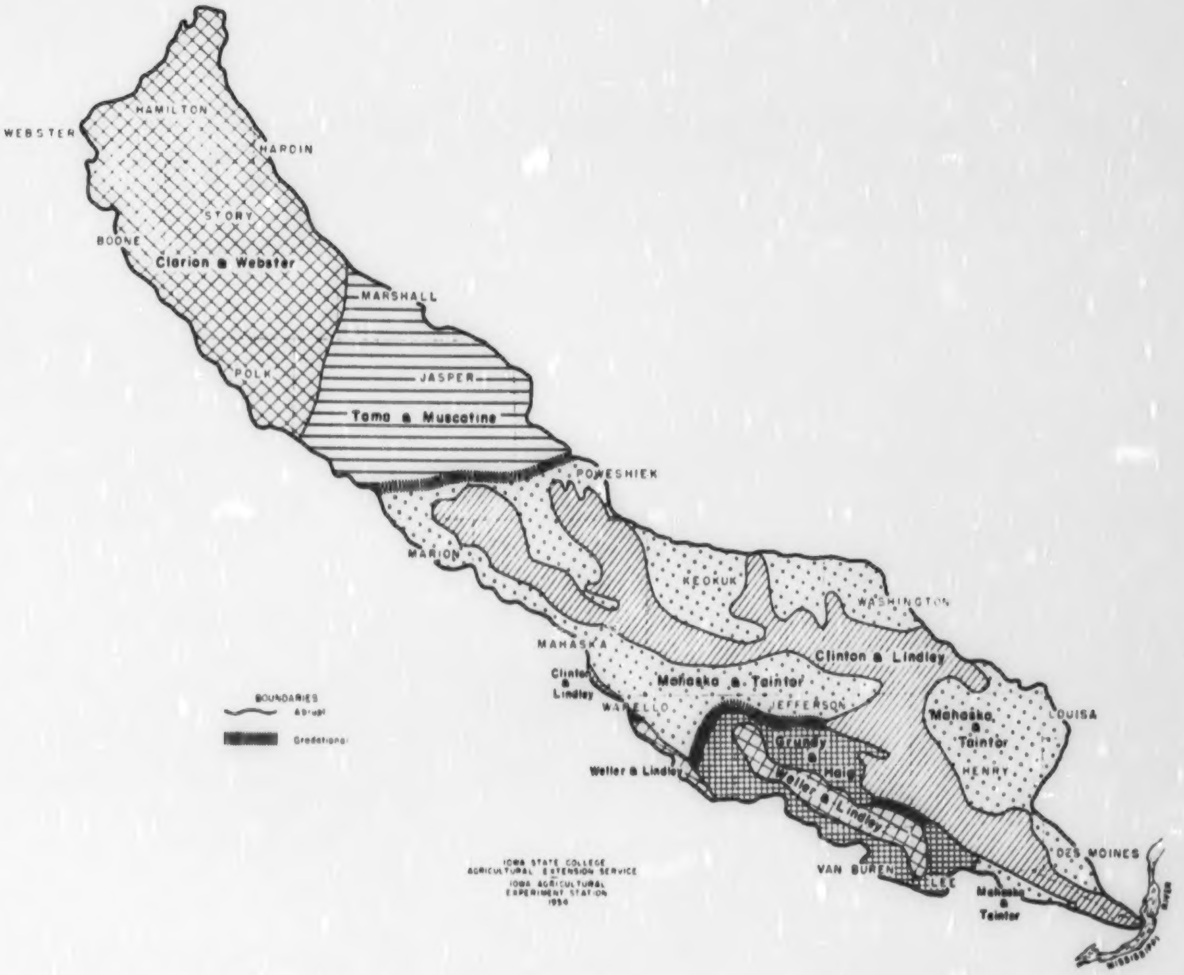

WEBSTER
HAMILTON
HARDIN
STORY
BOONE
Clarion & Webster
MARSHALL
POLK
JASPER
Tama & Muscatine
POWESHIEK
MARION
KEOKUK
WASHINGTON
MAHASKA
Clinton & Lindley
Clinton & Lindley
Mahaska & Taintor
WAPELLO
JEFFERSON
Mahaska & Taintor
LOUISA
Grundy & Haig
Weller & Lindley
Weller & Lindley
HENRY
DES MOINES
VAN BUREN
LEE
Mahaska & Taintor
Skunk
Mississippi
BOUNDARIES
Abrupt
Gradational
IOWA STATE COLLEGE
AGRICULTURAL EXTENSION SERVICE
IOWA AGRICULTURAL
EXPERIMENT STATION
1954

FIGURE III-3

PRINCIPAL SOIL ASSOCIATION AREAS - SKUNK RIVER BASIN(1) are described briefly in the following paragraphs.

Soils of the Late Wisconsin Drift - The Clarion-Webster soil association is found in that part of the upper basin which was covered by the Cary and Mankato lobes of the Wisconsin glacier. The parent material is primarily young calcareous glacial till which is only slightly weathered and leached to a shallow depth. The majority of the soils in this association were developed under native prairie grass vegetation. However, areas of poor natural drainage originally had a sedge cover, and minor areas occurring on the steeper slopes which border the larger streams were developed under forest cover. Drainage is the major problem in this area of nearly level terrain, and ponding may occur when rainfall is excessive. The major soils of this association are Clarion, Webster, Nicollet, Glencoe, and Storden. With their high organic matter and mineral content these soils are some of the most productive in the state.

Soils of the loess area - Soil associations of the loess area are the Tama-Muscatine, Mahaska-Taintor, Grundy-Haig, Clinton-Lindley, and Weller-Lindley. These include the loess-covered ridges and level uplands in the Kansan and Illinoian drift area in the middle and lower parts of the Skunk River Basin as well as the drift-derived soils on slopes where the loess covering has been removed by erosion. The maximum thickness of the loess ranges from 6 to more than 18 feet on the level uplands, and, unlike the loess adjacent to the Missouri River in western Iowa, it is noncalcareous, the calcium carbonate having been removed by leaching. The loessial soils of the Tama-Muscatine, Mahaska-Taintor, and Grundy-Haig associations were formed under a cover of prairie grasses and in general are more fertile than soils of the Clinton-Lindley and Weller-Lindley associations which were developed under a cover of hardwood forests. In all 5 association areas the loess has been eroded from most of the step slopes and even some gentle slopes, and Shelby and Lindley soils are differentiated on the exposed Kansan or Illinoian drift. Soils of the Shelby series developed under grass cover, and soils of the Lindley series originally had a hardwood forest cover.

Soils of the bottomlands and terraces - Bottomland and terrace soils are important along the Skunk River, particularly in Story, Polk, and Jasper Counties, and along the major tributaries of the Skunk River. Bottomland soils are derived from a wide variety of materials deposited as alluvium along the streams, and, as a result, they differ greatly in their natural characteristics. Many bottomland soils are heavy-textured and of low permeability and water moves through them slowly; other bottomland soils are sandy and of rapid permeability. The terraces are remnants of earlier flood plains which were formed when streams flowed at higher levels. They are above flood heights and usually are well drained.

Mineral Resources - The mineral resources of the basin consist primarily of coal, clay, sand and gravel, limestone, and dolomite. Almost all of the basin is underlain by coal measures of the Pennsylvanian series, but production of coal within the basin at the present time is very limited.

Sand and gravel from glacial and stream deposits are locally important. The gravel is used for road material and both sand and gravel are used for construction. Limestone and dolomite are quarried throughout the basin for road surfacing, riprap, railroad ballast, concrete aggregate, and agricultural limestone. Although quarries are more numerous in the lower half of the basin, one large quarry is located north of Ames. Sandstone is quarried in Jasper County, and brick and tile are manufactured in Nevada, Oskaloosa, and What Cheer from local deposits of clay.

Forest Resources - Upland forests and farm woodlots constitute an important resource in parts of the Skunk River Basin. They furnish wood for building construction, fence posts, and similar materials. Forests cover an estimated 8.5 percent of the land area in the basin, or approximately 238,000 acres. In general the amount of wooded area increases progressively from the upper to the lower basin. In the Wisconsin drift area of the upper basin, the woodland acreage ranges from 2-4 percent of the land in Hamilton and Story Counties. In the middle basin counties, Jasper, Poweshiek, Mahaska, and Keokuk woodlands constitute 5-9 percent of the total area. In the lower basin Jefferson, Washington, and Henry Counties have 10-14 percent of their land in forests, and Lee County in the extreme lower end of the basin is 24 percent woodland. On a state-wide basis Lee County ranks third to Allamakee County in extreme northeastern Iowa and Monroe county in south central Iowa in the extent of forest cover.

Woodlands are located principally on the bottomlands and valley slopes adjacent to the major streams and their value as a natural resource, woodland, in most cases, provide the most suitable cover for proper management of the areas involved and are invaluable for erosion control and watershed protection on the steep valley slopes. Unfortunately, about 80 percent of the basin woodland is pastured, and other poor management practices are common. Consequently the woodlands are generally of poor quality and their full potential value is not being realized. In addition to the acreage presently in woodland, many submarginal areas now pastured or cultivated could be utilized more wisely for timber production or wildlife area development.

GENERAL CLIMATOLOGY (7)

Because of the agricultural character of the basin the relationship of climate to growing season is of particular importance. Weather conditions during the crop growing season are of most significance, and so this period extending from April through September is differentiated from the dormant season during the remaining six months of the year.

Mean annual temperature in the basin varies from 49° at Ames to 52°F near Mount Pleasant. Average temperatures during the growing season vary from 67 degrees in the lower portion of the basin to 65 degrees in the upper portion. The frost-free period varies from about 190 days in the southern part of the basin to less than 150 days in Hamilton County. About 71 percent, or approximately 23 inches, of the average annual rainfall in the basin occurs during the growing season, mostly in the form of thunderstorms. If properly distributed, this amount is adequate for satisfactory crop growth.

Average annual snowfall for the basin is about 27 inches, but the upper end of the basin exceeds 32 inches. Snowfall usually accounts for about ten percent of the total annual precipitation.

Summer winds are variable, but commonly are from the southern quadrant, bringing moist air from the Gulf of Mexico. This moisture is precipitated mainly by thunderstorms. General droughts have been extremely rare, although summer storms may be so distributed that some areas receive inadequate moisture temporarily.

A more complete discussion of the general climatology of Iowa is given in the Supporting Document (7).

SURFACE WATERS

Stream Flow

That portion of the original precipitation which flows across the land surface and escapes into artificial and natural drainage channels is often referred to as storm runoff. It is the runoff supplemented by discharge from groundwater sources that constitutes the flow observed in streams. Obviously, streamflow is highly correlated to precipitation, which varies from year to year and from area to area. Precipitation and streamflow also vary with time. While some years are in the normal range, others can be either wet or dry.

The average annual runoff in the basin ranges from more than five inches in extreme northwest to more than seven inches in the southeast (4). Runoff follows, in general, the pattern of the mean annual precipitation which ranges from about 29 to more than 34 inches from the northwestern to the southeastern parts of the basin (7).

Although no definite cycles are apparent, runoff tends to be above, or below, average for periods longer than one year. The longest periods when runoff was above average were the two six-year periods 1915-20 and 1942-47. The longest below-average period was the seven years from 1953 to 1959. Statistics on the extremes of annual runoff at selected stations in the basin are listed in Table III-4.

The stations included in Table III-4 are those measuring the flow from drainage areas of moderate size, and those whose records included the drought of the mid-1950's. The smallest drainage areas are too sensitive to indicate hydrologic conditions; whereas large drainage areas, which integrate

TABLE III-4

ANNUAL RUNOFF AND INDICATORS OF FLOW VARIABILITY FOR SELECTED STATIONS
IN THE SKUNK RIVER BASIN

Station Name	Period of Record	Drainage area sq. mi.	Mean flow cfs.	Annual runoff in inches					Q2.33* / Qmean	Q90** / Qmean
				Mean	Max.	Year	Min.	Year		
South Skunk Riv. near Ames	1920-27, '32-67	315	132	5.70	12.81	1944	.24	1958	32.2	.01
North Skunk Riv. near Sigourney	1945-67	730	393	7.33	16.04	1960	.52	1956	16.8	.03
Big Creek near Mt. Pleasant	1955-67	106	57.2	7.33	17.39	1965	.50	1957	38.3	<.002

Note: Minimum annual runoff for period through 1968.
* Q2.33 is mean annual flood; Qmean is mean flow.
** Q90 is flow equaled or exceeded 90 percent of time; Qmean is mean flow.

widespread meteorologic and physical regimes, are too insensitive to be truly representative of areal conditions.

Streamflow is characteristically variable. Knowledge of average flow alone, is insufficient for careful planning and management. In Iowa, it is common for peak flows to be 10,000 or more times the minimum flows. As an indicator of the variability of high flows, the ratio of the mean annual flood to the mean discharge for selected stations in the basin is listed in Table III-4. The mean annual flood is a fairly stable statistic which is unaffected, for the most part, by the chance occurrence of a very large flood. It is the peak flow that is equaled or exceeded once on an average of about every other year (recurrence interval, 2.33 years). The values for the ratio of the mean annual flood to the mean flow, for stations listed in Table III-4, varied from 16.8 to 38.3.

As an index of the variability of low flows, the ratio of the flow at the 90 percent duration level (Q90) to the mean flow is also listed in Table III-4. This ratio varies from near zero to 0.03.

From this brief analysis, it is obvious that streamflow is highly variable. On the average, every other year a peak flow is reached that is about 30 or more times the mean flow. During 10 percent of the time, low flows are at or lower than about 3 percent of the mean flow.

Low Flow Characteristics

Water quality criteria of the State of Iowa must be met at all times when the flow of the stream equals or exceeds the statistical 7-day, 1-in-10 year low flow. Information on this flow and the physical characteristics of the stream are needed if the assimilative capacity is to be analyzed and allowable discharges determined.

The United States Geological Survey (USGS) maintains an extensive nationwide network of stream gaging stations. Stream flow is monitored continuously at some stations and periodically at others. By extrapolation of data from this established gage network and review of partial-record stations, additional flow information may be determined for streams where continuously recording gaging stations are not provided. Not all gages in a river basin are of the same period of record; therefore, published values of statistical flows such as Q90 (the flow equaled or exceeded 90% of the time) or the 7-day, 1-in-10 year low flow cannot be expected to correlate exactly at different gages.

Specific USGS gaging station locations are shown on Figure III-4. Both partial-record and continuous recording gaging stations are identified. Table III-5 lists the specific station number, tributary drainage area above the station, and the 7-day, 1-in-10 year low flow, where available, for each station. As indicated in the table, insuf-

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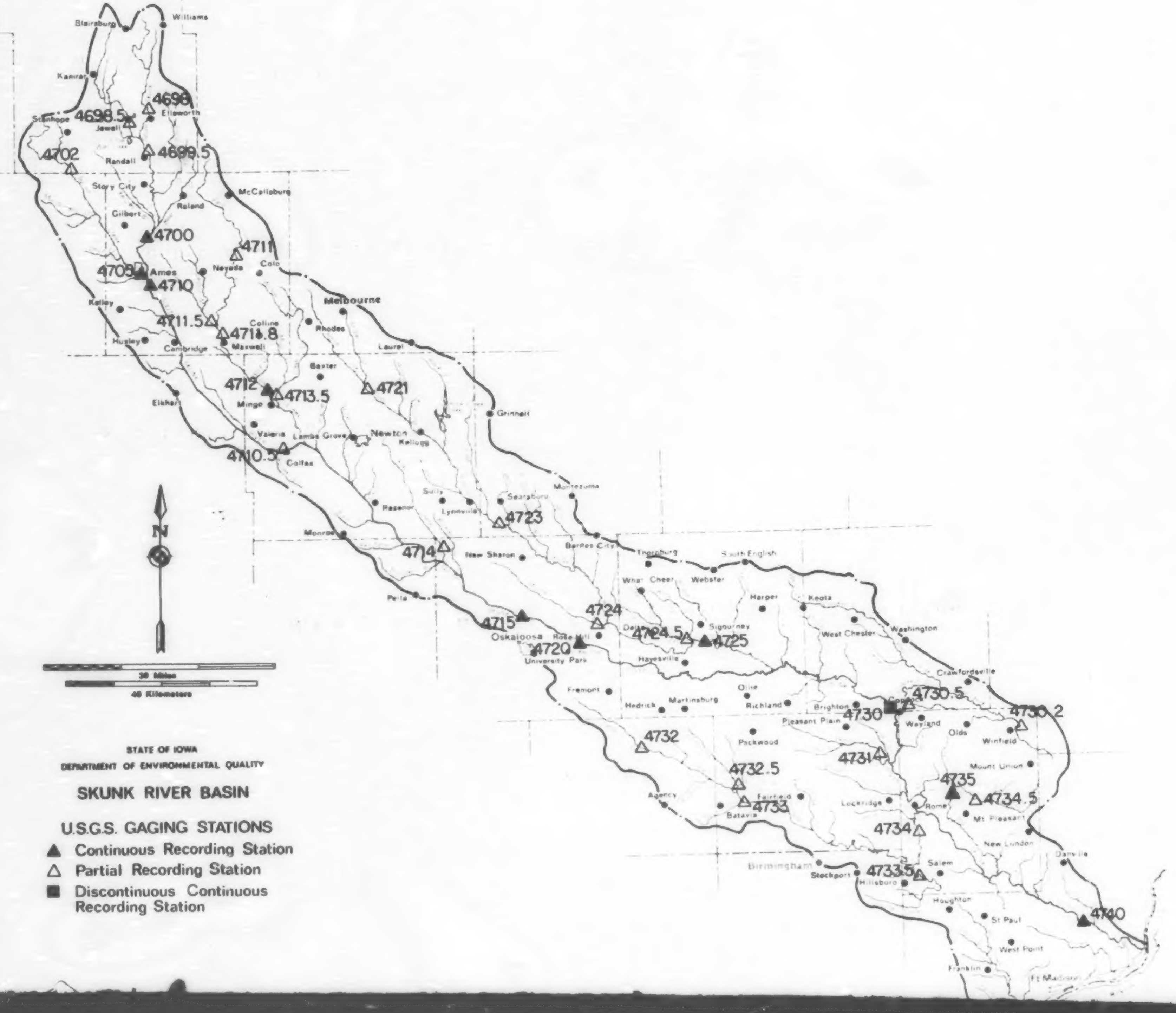
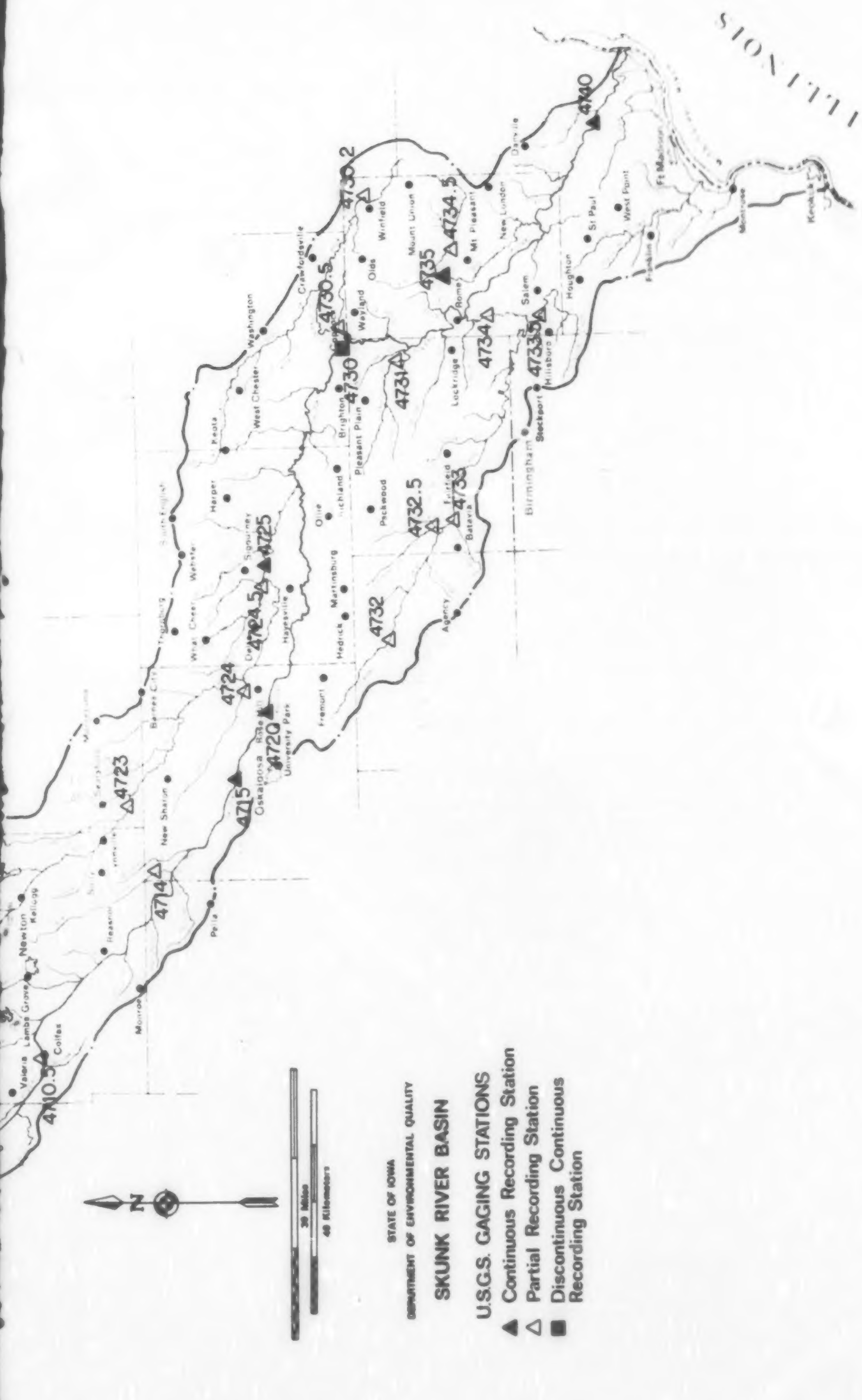

Blairsburg
Williams
Kamrar
4698
4698.5
Stanhope
Jewell
Ellsworth
4702
Randall
4699.5
Story City
McCallsburg
Gilbert
Roland
4700
4711
4705
Ames
Nevada
Colo
4710
Melbourne
Kelley
4711.5
Collins
4711.8
Rhodes
Huxley
Cambridge
Maxwell
Laurel
Baxter
4712
4713.5
4721
Elkhart
Mingo
Grinnell
Valeria
Lambs Grove
Newton
Kellogg
4710.5
Colfax
Sully
Searsboro
Montezuma
Reasnor
Lynnville
4723
Monroe
Barnes City
4714
New Sharon
Thornburg
South English
What Cheer
Webster
Pella
Harper
Keota
4724
4715
Oskaloosa
Rose Hill
4724.5
Sigourney
4725
West Chester
Washington
4720
University Park
Hayesville
Crawfordsville
Fremont
Ollie
Hedrick
Martinsburg
Richland
Brighton
4730.5
4730
4730.2
Pleasant Plain
Wayland
Olds
Winfield
4732
Packwood
4731
Mount Union
4732.5
4735
Agency
Fairfield
Lockridge
Rome
4734.5
Batavia
4733
Mt Pleasant
4734
New London
Danville
Birmingham
Stockport
4733.5
Hillsboro
Salem
Houghton
St Paul
4740
West Point
Franklin
Ft Madison
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SKUNK RIVER BASIN

U.S.G.S. GAGING STATIONS

- ▲ Continuous Recording Station
- △ Partial Recording Station
- ■ Discontinuous Continuous Recording Station


STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SKUNK RIVER BASIN
U.S.G.S. GAGING STATIONS
▲ Continuous Recording Station
△ Partial Recording Station
■ Discontinuous Continuous Recording Station
20 Miles
40 Kilometers
N
ILLINOIS
4710.5
4714
4715
4720
4723
4724
4724.5
4725
4730
4730.2
4730.5
4731
4732
4732.5
4733
4733.5
4734
4734.5
4735
4740
Valeria
Lambs Grove
Colfax
Newton
Kellogg
Monroe
Pella
New Sharon
Oskaloosa
University Park
Fremont
Hedrick
Martinsburg
Hayesville
Sigourney
Webster
What Cheer
Thornburg
Barnes City
South English
Harper
Keota
West Chester
Washington
Crawfordsville
Ollie
Richland
Packwood
Pleasant Plain
Brighton
Wayland
Olds
Winfield
Mount Union
Mt Pleasant
New London
Danville
Rome
Lockridge
Salem
Hillsboro
Houghton
St Paul
West Point
Ft Madison
Franklin
Montrose
Keokuk
Fairfield
Batavia
Agency
Birmingham
Stockport

B FIGURE III-4

Table III-5

U.S.G.S. GAGING STATION INFORMATION (5)
Skunk River Basin

Station No.	Stream[1]	Location	Drainage Area (Mi^2)	7010	
				(cfs	(cfs/mi^2)
4698	S. Skunk River	Near Ellsworth	54.9	0	0
4698.5	Mud Lake Drainage Ditch 71	Jewell	64.1	---	---
4699.5	S. Skunk River	Randall	160	---	---
4700	S. Skunk River	Near Ames	315	---	---
4702	Squaw Creek	Near Stanhope	62.6	---	---
4705	Squaw Creek	Ames	204	---	---
4710	S. Skunk River	Near Ames	556	---	---
4711	E. B. Indian Creek	Near Nevada	65.7	---	---
4711.5	W. B. Indian Creek	Near Iowa Center	65.9	---	---
4711.8	Indian Creek	Near Iowa Center	203	---	---
4712	Indian Creek	Near Mingo	276	---	---
4713.5	Clear Creek	Near Mingo	84.1	---	---
4714	Elk Creek	Near Taintor	59.9	<0.1	---
4715	S. Skunk River	Near Oskaloosa	1,635	4.8	0.0029
4721	N. Skunk River	Near Newton	101	---	---
4723	N. Skunk River	Near Searsboro	385	---	---
4724	Middle Creek	Near Rose Hill	58.5	0	0
4724.5	Cedar Creek	Near Sigourney	92.5	0.1	---

Table III-5 (Continued)

U.S.G.S. GAGING STATION INFORMATION (5)
Skunk River Basin

Station No.	Stream[1]	Location	Drainage Area (Mi^2)	7Q10	
					(cfs/mi^2)
4725	N. Skunk River	Near Sigourney	730	0.98	0.0013
4730	Skunk River	Coppock	2,916	20	0.0069
4730.2	E. F. Crooked Creek	Near Winfield	65.3	$<$0.1	---
4730.5	Crooked Creek	Near Coppock	259	0	0
4731	Walnut Creek	Germanville	66.3	0	0
4732	Cedar Creek	Near Highland Center	73.6	0	0
4732.5	Competine Creek	Near Batavia	68.8	0	0
4733	Cedar Creek	Near Batavia	252	0	0
4733.5	L. Cedar Creek	Near Salem	55.0	---	---
4734	Cedar Creek	Near Oakland Mills	522	$<$0.1	---
4734.5	Big Creek	Mt. Pleasant	58	0	0
4735	Big Creek	Near Mt. Pleasant	106	---	---
4740	Skunk River	Augusta	4,303	20	0.0046

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[1] Water Resources Data for Iowa, USGS, 1971.

ficient data are available for identification of low flow at each gaging station.

The frequency of these extreme low flows is seasonal within the basin, i.e. due to the climatological and geological characteristics of the basin, low flows tend to occur either during August and September or during January and February of any given year. For this reason, analyses of critical conditions for defining waste load allocations must be conducted for both warm and cold water temperatures.

In general, low flows in the Skunk River Basin are significantly less than the state average when results are reduced to the common basis of discharge per square mile. This can be seen in Table III-6. The table gives a comparison of averages from long-term continuously recording gaging stations within the basin to the average for 84 stations within the State of Iowa.

TABLE III-6

FLOW COMPARISONS (5)

	Flow, in CFS/sq mi, Equaled or Exceeded, for Percentage of Time Indicated in Column Headings				
	50	90	95	98	99
State of Iowa Average	0.150	0.033	0.024	0.018	0.015
Skunk River Basin Average	0.198	0.020	0.012	0.006	0.004

As with the daily flow data presented, the average 7-day, 1-in-10 year low flow for the basin is considerably lower than that for the entire state. The 7-day, 1-in-10 year low flow for the Skunk River Basin averages 0.00286 cfs/sq mi. while the State of Iowa averages 0.020 cfs/sq mi.

HYDROGEOLOGY (1, 4, 6)

Groundwater yielding strata may be divided into three classes of aquifers; shallow unconsolidated deposits, deep unconsolidated deposits, and consolidated deposits. Shallow unconsolidated deposits are arbitrarily limited to a maximum depth of 100 feet and consist principally of sands and gravels of glacial or stream origin. Deep unconsolidated deposits are of the same material but more than 100 feet in depth. Consolidated deposits consist of various permeable bedrock strata, chiefly limestone, dolomite, and sandstone.

Unconsolidated Deposits

Shallow Unconsolidated Deposits - Shallow unconsolidated deposits are generally poor producers if located in the uplands and are used mainly for low production private wells. However, some shallow deposits in the stream valleys are large producers. Sand and gravel deposits confined mostly to the immediate valley of the Skunk River are capable of yielding more than 500 gpm to individual wells, while deposits along the tributaries and in some buried valleys are capable of yielding more than 40 gpm to individual wells. Inasmuch as they are recharged directly from precipitation and streams, they reflect fluctuations in rainfall and stream flow and are often adversely affected by drought. High producing shallow aquifers are located at Kellogg, Newton, Oskaloosa, and Sigourney where the sands are probably fed directly from surface water supplies.

Deep Unconsolidated Deposits - Recharge of deep unconsolidated deposits is dependent on surface sources much as in the case of shallow deposits. Some of the best aquifers are found in preglacial and interglacial stream valleys and have subsequently been covered by younger drift materials or alluvium. Such sources are difficult to locate but are prolific water producers. Deep supplies are less susceptible to effects of drought than shallow supplies.

Consolidated Deposits

Rock aquifers are found in the consolidated formations below Pleistocene drifts. Rocks of Pennsylvanian age are immediately beneath the glacial deposits throughout most of the upper basin and along the western margin of the lower basin. The remainder of the basin is underlain by the older rocks of Mississippian Age. Beneath these outcrop beds are the progressively older rocks of the Devonian, Silurian, Ordovician, Cambrian, and Pre-Cambrian Systems. All of these beds, with the exception of the Pre-Cambrian, outcrop in progressively older belts in Iowa to the northeast of the Skunk River Basin, and it is believed that the principal source of groundwater found in these rocks is at the area of outcrop.

Yields from the upper and middle bedrock aquifers are usually in the order of 100 gpm. Yields from the lower bedrock aquifers are considerably higher, with yields over 1,000 gpm, but they lie in the order of 1,000 feet or greater below the surface.

For further information, a more detailed discussion of the hydrogeology for the state is given in the Supporting Document (7).

GROUND WATER QUALITY (1, 4)

The mineral content of the groundwater, described by total dissolved solids and hardness, generally increases with increasing depth. Some alluvial aquifers will yield water with a hardness of from 150 to 200 mg/l, and water from some bedrock aquifers in areas where they yield higher mineralized water often will have a hardness in excess of 1,000 mg/l. These waters usually grade from calcium or calcium magnesium to the sodium type and from bicarbonate to sulfate or chloride type in areas where the dissolved-solids content increases.

Generally, water containing less than 500 mg/l of dissolved solids can be found in the alluvial aquifers of the basin except in the upstream end of the Skunk River (Story County and above) where between 500 and 1000 mg/l is expected.

In the Pennsylvanian system, aquifers generally produce water of high mineral content, particularly sulphates, and for this reason they are not regarded as desirable supplies. There are areas of medium or coarse-grained sandstones in this system which yield water of good quality, but they are discontinuous and difficult to locate. A number of towns in the basin, including Monroe and New Sharon, obtain their water supplies from the Pennsylvanian system in spite of these difficulties.

In the Mississippian aquifer dissolved solids range from less than 500 mg/l in the southern and extreme northern portions of the basin to greater than 2500 mg/l in the north central. In the far northeastern corner, dissolved solids in the Silurian-Devonian aquifer are generally less than 1000 mg/l but greater than 2500 mg/l over about the southern two-thirds of the basin. In the Jordan aquifer dissolved solids range from between 500 to 1000 mg/l in the central portion of the basin to between 1000 and 1500 in the northern and southern portions.

Iron occurs in amounts (more than 0.3 mg/l) which can cause problems in some places in all aquifers. Iron in troublesome amounts is commonly found in water from the alluvial aquifers, in sand aquifers beneath the glacial drift, and in near-surface bedrock aquifers.

Nitrates in excess of acceptable concentrations have been found in many shallow wells. The occurrence of high nitrate concentrations is related more to improper well construction and location than to a particular region. Instances of properly constructed wells yielding high nitrate concentrations are, however, common in some alluvial aquifers.

Fluoride may be high in water taken from the Mississippian aquifer in the northern end of the basin.

For further information on ground water quality, a more detailed discussion is given in the Supporting Document (7).

REFERENCES

1. *An Inventory of Water Resources and Water Problems, Skunk River Basin, Iowa*, prepared by the Iowa Natural Resources Council, 1957.

2. R. H. Shaw and P. J. Waite. *The Climate of Iowa III Monthly, Crop Season and Animal Temperature and Precipitation Normals for Iowa*, Agricultural and Home Economics Experiment Station, Iowa State University of Science and Technology, Ames, Iowa, April 1964.

3. Ivan L. Burnmeisler, *The Streamflow Data Program in Iowa* U.S. Department of Interior, Geological Survey, Water Resources Division, Iowa City, Iowa, 1970.

4. *Water Resources of Iowa*, Ed. Paul J. Horick, University Printing Service, Iowa City, Iowa, January 1970.

5. *Low Flow Characteristics of Iowa Streams Through 1966*, Albert J. Heinitz, prepared by the U.S. Geological Survey, Water Resources Division, in cooperation with the Iowa Natural Resources Council, State of Iowa, 1970

6. *Upper Mississippi River Comprehensive Basin Study*, Vol. III, Appendix E: Ground Water and Geology, prepared by the Economic Advisory Committee, Upper Mississippi River Basin Coordinating Committee, 1970.

7. *Supporting Document for Iowa Water Quality Management Plans*, Iowa Department of Environmental Quality, Water Quality Management Division, Des Moines, Iowa.

CHAPTER IV - WATER QUALITY

The main objective of water quality management is to protect and enhance the water resources to ensure acceptable conditions for designated uses. Sound management first requires knowledge of the existing water quality.

Existing water quality for the Skunk River Basin has been identified from available data. The data indicate some areas of degraded water quality.

It is the purpose of water quality standards to limit waste inputs to streams so that designated water uses will not be impaired.

The Iowa Water Quality Commission has classified streams into four classifications: A, B, C, and General. Class A Waters are those which are to be preserved for whole body contact. Class B Waters are those which are to be preserved for wildlife, aquatic life, and non-body contact recreation. Class C Waters are those which must be of a quality to meet requirements for use as a potable water supply. The General classification, which applies to all surface waters, provides for generally acceptable physical conditions and elimination of toxic substances. The Supporting Document for Iowa Water Quality Management Plans, lists the standards in detail for each class.

In addition to material contamination, thermal discharges are important to water quality, since many life forms cannot adapt to a wide range of temperature. Temperature variation within a stream can result in different proportions of species and may even result in the disappearance of some forms and the appearance of others. Standards have been set for thermal discharges and streams have been further classified as to being "cold water" or "warm water".

Table IV-1, from the Water Quality Standards, Chapter 16, Iowa Departmental Rules, lists the classification of streams in the Skunk River Basin, and Figure IV-1 shows those streams classified A, B, or C.

The U.S. Environmental Protection Agency (EPA) has prepared a set of proposed criteria for water quality that differs in some instances from Iowa's standards. These are also presented in the Supporting Document. It is likely that Iowa's standards and EPA standards will become very nearly identical. Although the present standards may be different, their purposes are the same -- to manage water quality to meet the best interest of all users.

SAMPLING LOCATIONS

The evaluation of water quality in the Skunk River Basin is based upon data collected by the DEQ, the State Health Department, the State Hygienic Laboratory, and Iowa State University. Some additional data are available from other State, local, and Federal agencies.

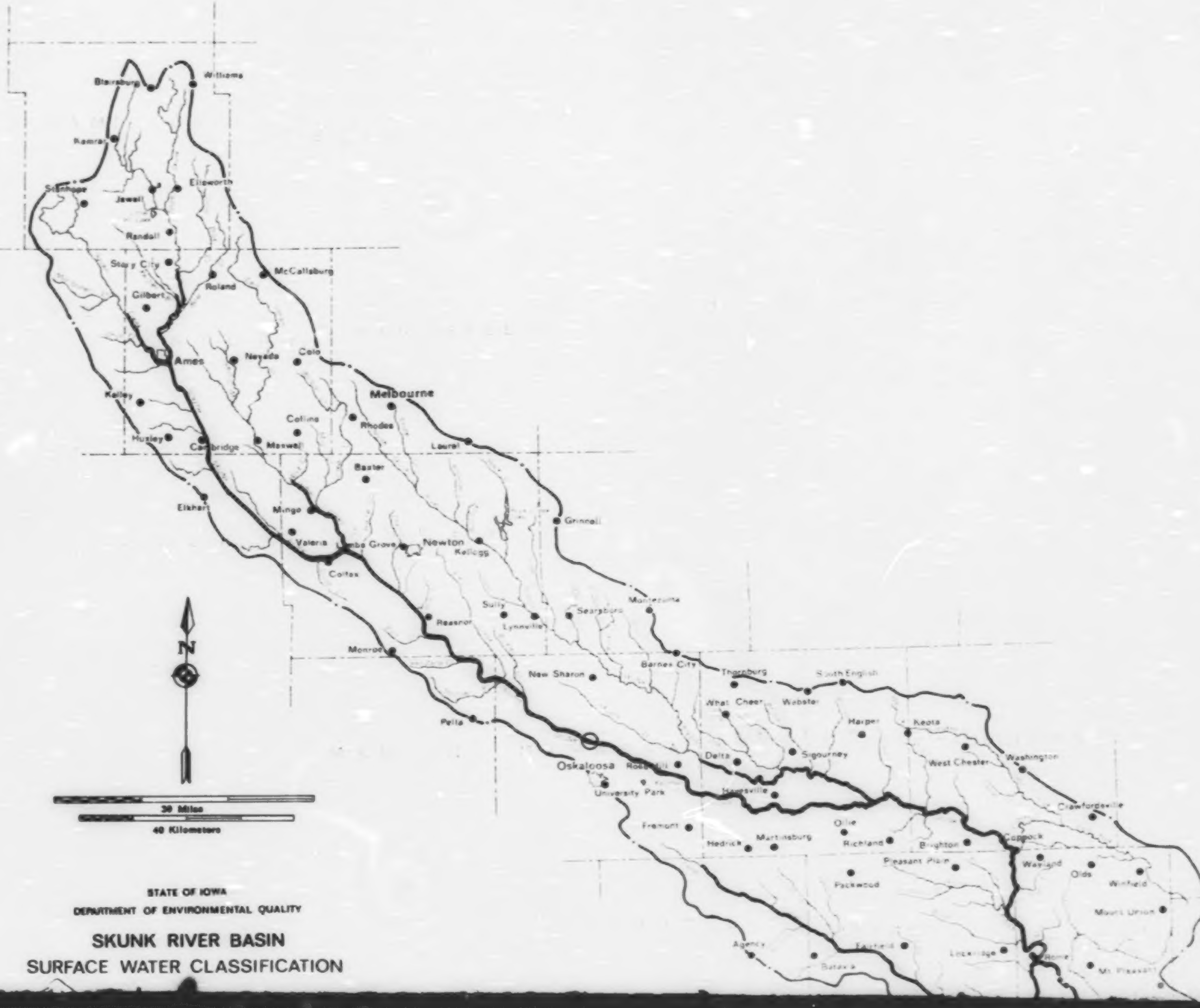
Table IV - 1

SURFACE WATER CLASSIFICATION

SKUNK RIVER BASIN

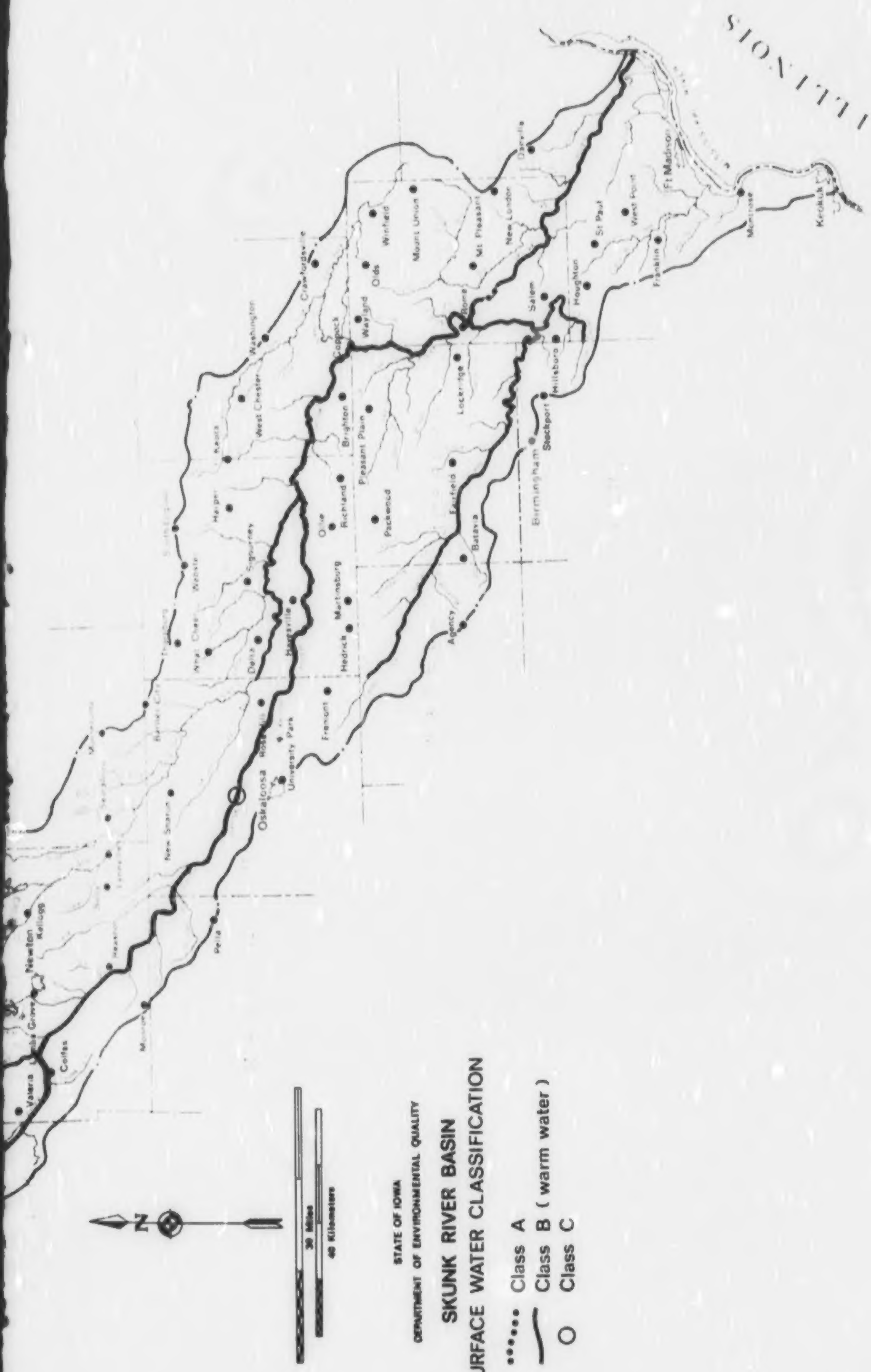
Stream Segment	Classification		
	A	B Warm Water	C
A. Mississippi River - Main Stem Mo. State line to Minn. State line	X	X	X (Above Keokuk Ft. Madison Burlington & Davenport)
2. Skunk River			
mouth to Oakland Mills		X	
Oakland Mills Impoundment	X	X	
Oakland Mills Impound to confl. of N. & S. Skunk River		X	
a. Cedar Creek mouth to Highway 63		X	
(1) Little Cedar Creek mouth to Van Buren Co. line		X	
b. N. Skunk River mouth to Mahaska Co. line		X	
c. S. Skunk River mouth to Highway 221		X	X (Above Oskaloosa)
(1) Indian Creek mouth to confl. with Wolf Creek		X	
(2) Squaw Creek mouth to confl. with Story Co. D.D. 70		X	
(3) Keigley Branch mouth to confl. with Hamilton-Story D.D. 1		X	

A


Blairsburg
Williams
Kamrar
Ellsworth
Stanhope
Jewell
Randall
Story City
McCallsburg
Roland
Gilbert
Ames
Nevada
Colo
Melbourne
Kelley
Collins
Rhodes
Huxley
Cambridge
Maxwell
Laurel
Baxter
Elkhart
Mingo
Grinnell
Valeria
Lambs Grove
Newton
Kellogg
Colfax
Sully
Lynnville
Searsboro
Montezuma
Reasnor
Monroe
New Sharon
Barnes City
Thornburg
South English
What Cheer
Webster
Harper
Keota
Pella
Delta
Sigourney
West Chester
Washington
Oskaloosa
Rose Hill
University Park
Hayesville
Crawfordsville
Ollie
Fremont
Hedrick
Martinsburg
Richland
Brighton
Coppock
Pleasant Plain
Wayland
Olds
Winfield
Packwood
Mount Union
Agency
Fairfield
Batavia
Lockridge
Rome
Mt. Pleasant
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SKUNK RIVER BASIN
SURFACE WATER CLASSIFICATION


STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SKUNK RIVER BASIN
SURFACE WATER CLASSIFICATION
Class A
Class B (warm water)
Class C
30 Miles
40 Kilometers
N
ILLINOIS
Keokuk
Montrose
Ft Madison
West Point
St Paul
Franklin
Houghton
Salem
Hillsboro
Stockport
Birmingham
Danville
New London
Mt Pleasant
Mount Union
Winfield
Olds
Wayland
Rome
Coppock
Crawfordsville
Washington
West Chester
Keota
Brighton
Lockridge
Pleasant Plain
Fairfield
Packwood
Richland
Ollie
Batavia
Agency
Martinsburg
Hedrick
Fremont
Harper
Sigourney
Webster
What Cheer
Delta
Hayesville
Rose Hill
Oskaloosa
University Park
New Sharon
Barnes City
Pella
Kellogg
Newton
Monroe
Colfax
Valeria

B

FIGURE IV-1

All sampling locations in the Skunk River Basin are shown on Figure IV-2.

SKUNK RIVER

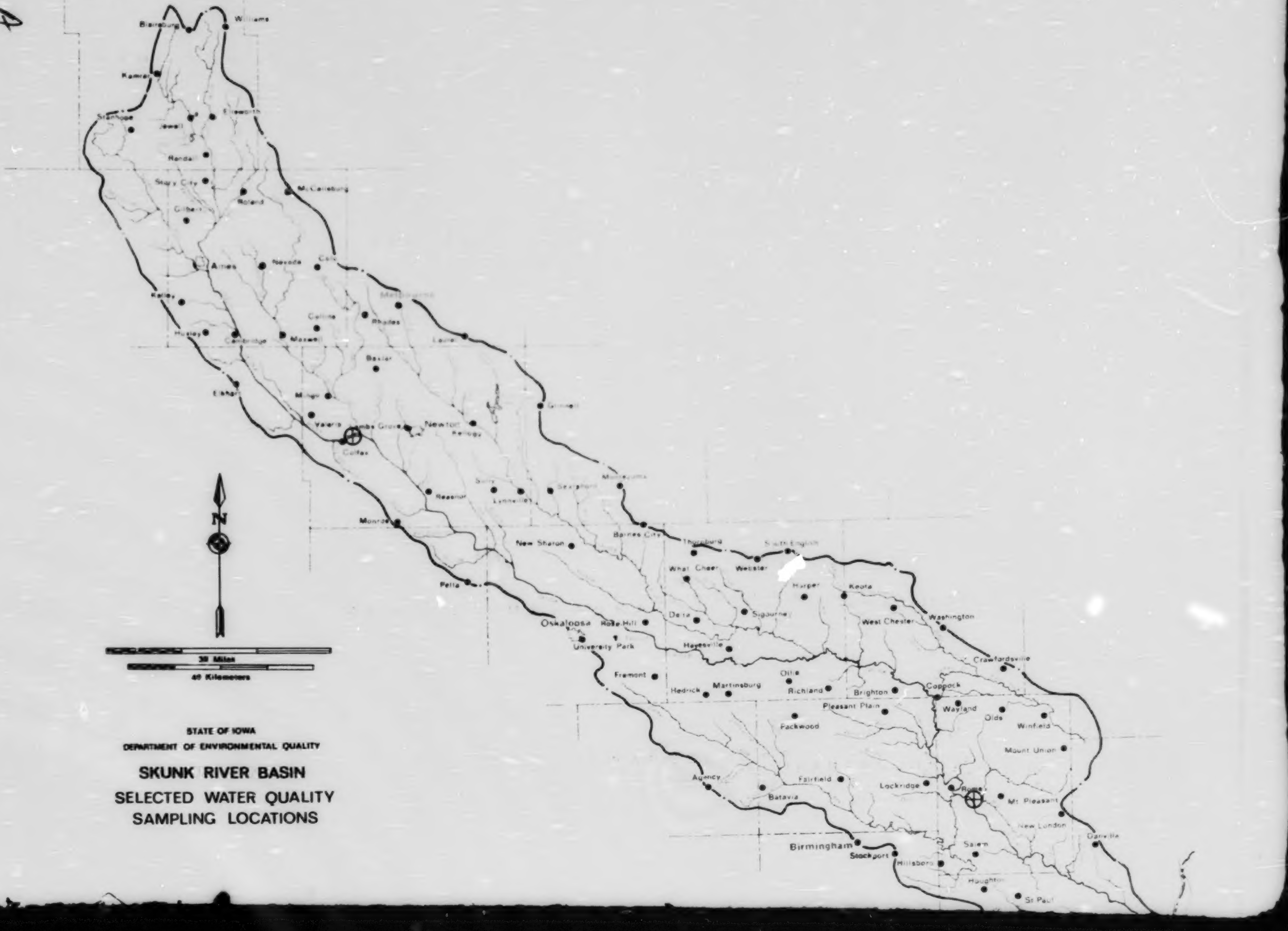
Water quality problems in the Skunk River are primarily related to low dissolved oxygen and high ammonia nitrogen concentrations. While water quality appears good during most periods, periods of low flows and ice cover could produce violations of critical dissolved oxygen and ammonia standards. High nutrient concentrations and turbidity have been associated with runoff.

Pollution Problems and Sources

Waste from municipal discharges to the Skunk River, particularly from Ames, may at times affect water quality along the entire length of the river. During ice cover and low flow conditions ammonia nitrogen and dissolved oxygen concentrations are significantly influenced by these discharges. Even during non-critical summer periods localized impacts on water quality including high bacterial counts, high nutrient levels, and low dissolved oxygen levels can occur.

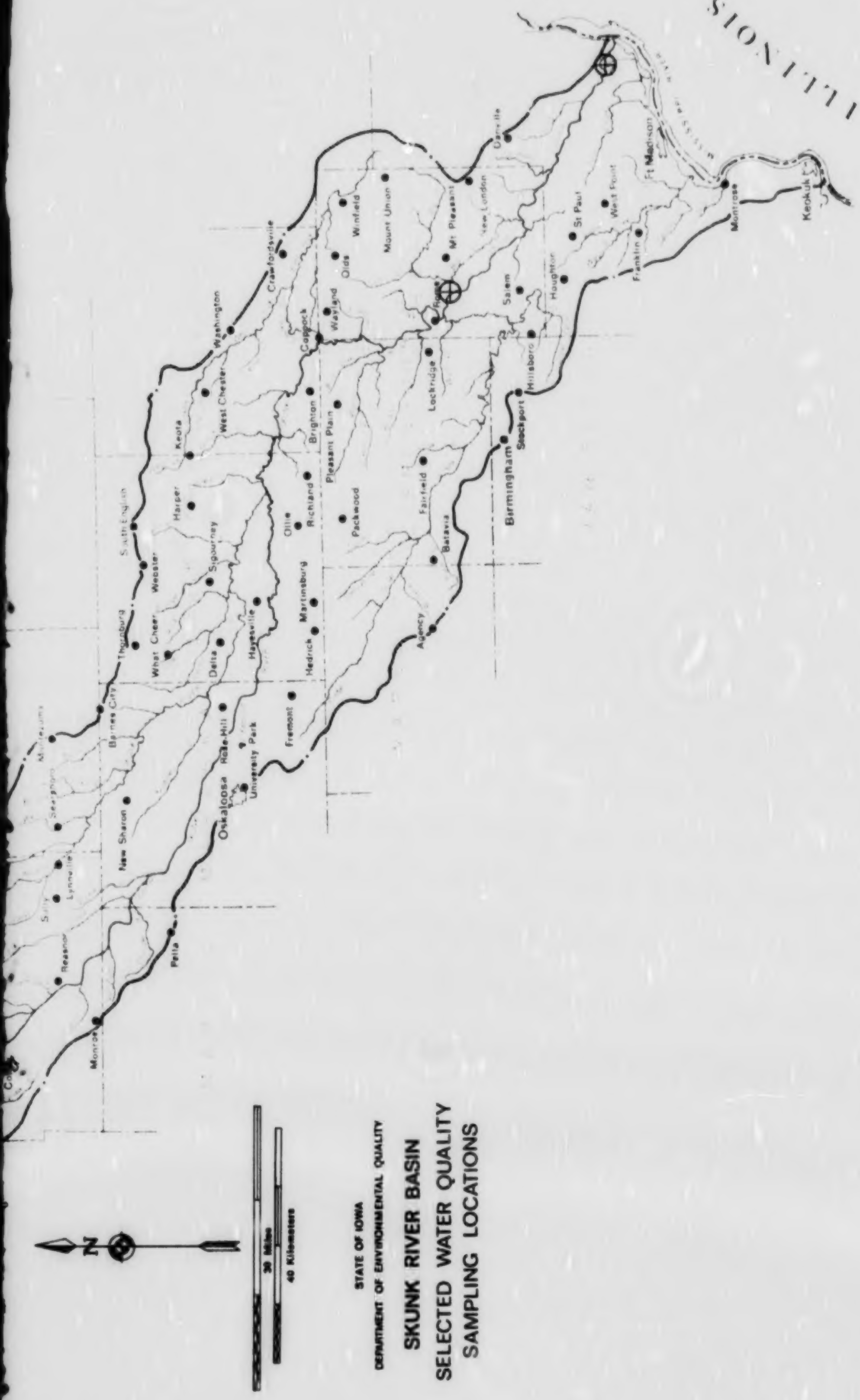
Some of the larger municipalities do not discharge directly into the Skunk River, but rather several miles up a tributary stream. The impact of these larger municipalities is often sufficient to influence water quality even on the main stem of the river. Only limited data are available to determine how significant these discharges may be. Additional information should aid in determining the magnitude of the impact of tributary point sources on Skunk River water quality.

A


Blairsburg
Williams
Kamrar
Stanhope
Jewell
Ellsworth
Randall
Story City
McCallsburg
Roland
Gilbert
Ames
Nevada
Colo
Melbourne
Kelley
Collins
Rhodes
Huxley
Cambridge
Maxwell
Laurel
Baxter
Elkhart
Mingo
Grinnell
Valeria
Lambs Grove
Newton
Kellogg
Colfax
Sully
Lynnville
Searsboro
Montezuma
Reasnor
Monroe
Barnes City
New Sharon
Thornburg
South English
What Cheer
Webster
Harper
Keota
Pella
Delta
Sigourney
West Chester
Washington
Oskaloosa
Rose Hill
University Park
Hayesville
Crawfordsville
Fremont
Hedrick
Martinsburg
Ollie
Richland
Brighton
Coppock
Wayland
Olds
Winfield
Pleasant Plain
Packwood
Mount Union
Agency
Batavia
Fairfield
Lockridge
Rome
Mt Pleasant
New London
Danville
Birmingham
Stockport
Hillsboro
Salem
Houghton
St Paul
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SKUNK RIVER BASIN
SELECTED WATER QUALITY
SAMPLING LOCATIONS


ILLINOIS
Mississippi River
Keokuk
Montrose
Ft Madison
West Point
St Paul
Franklin
Houghton
Salem
Danville
New London
Mt Pleasant
Mount Union
Winfield
Olds
Wayland
Crawfordsville
Washington
Coppock
West Chester
Keota
Brighton
Pleasant Plain
Lockridge
Hillsboro
Stockport
Birmingham
Fairfield
Batavia
Packwood
Richland
Ollie
Harper
South English
Webster
Sigourney
Martinsburg
Hedrick
Hayesville
Delta
What Cheer
Thornburg
Agency
Fremont
Rose Hill
University Park
Oskaloosa
Barnes City
Montezuma
Searsboro
New Sharon
Lynnville
Sully
Reasnor
Pella
Monroe
N
20 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SKUNK RIVER BASIN
SELECTED WATER QUALITY
SAMPLING LOCATIONS

B

FIGURE IV-2

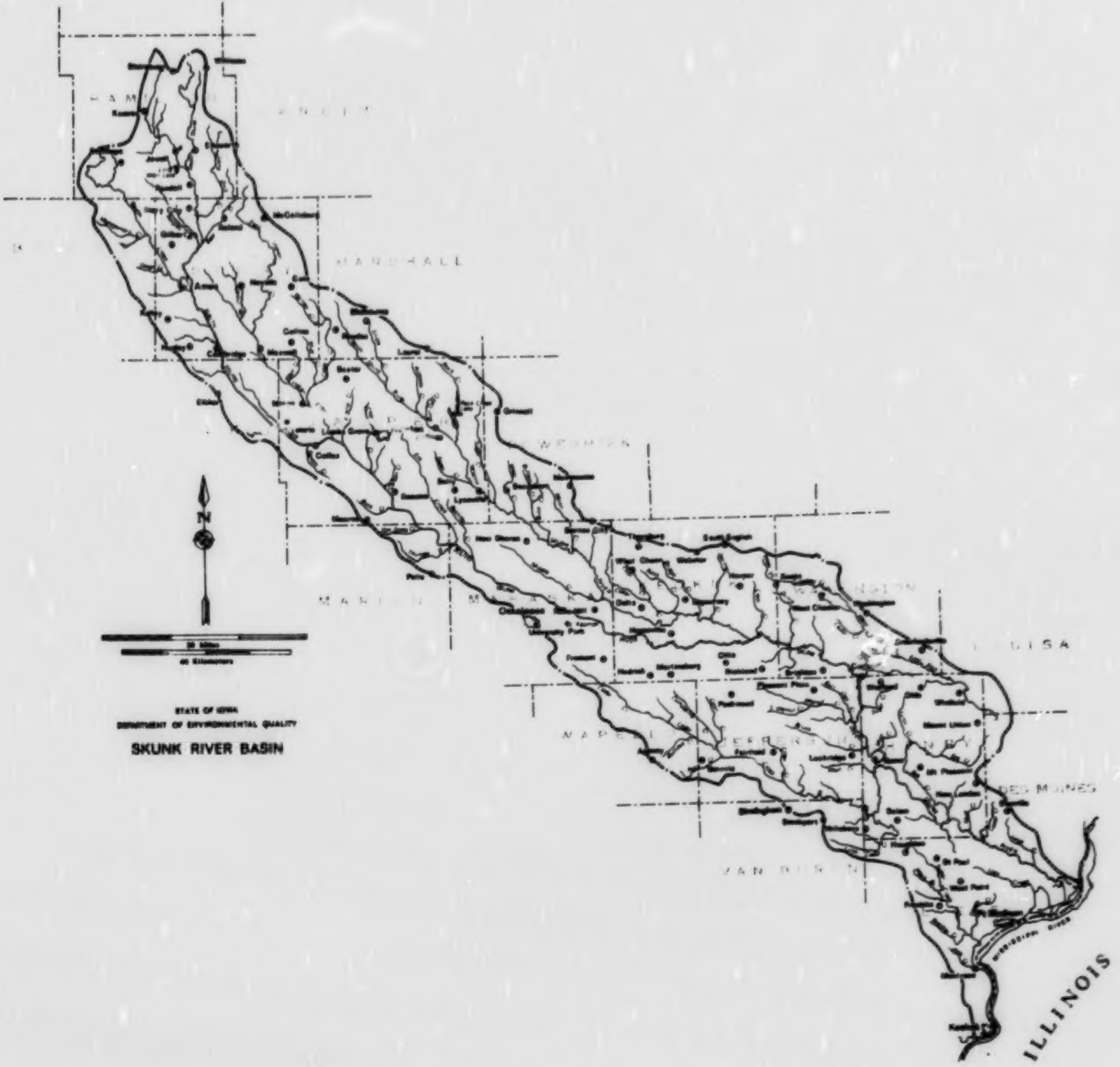

MARSHALL
MARION
WASHINGTON
LOUISA
DES MOINES
VAN BUREN
ILLINOIS
N
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SKUNK RIVER BASIN

FIGURE IV-3 SKUNK RIVER BASIN

Nonpoint sources may also be an important source of ammonia nitrogen, and appear to have caused at least some water quality violations. COD, nitrates, and turbidity have all been related to the magnitude of flow in the Skunk River. Nonpoint runoff also contributes pesticides to the river in concentrations higher than those recommended as maximum. Although all counties within the basin are organized into soil conservation districts, only limited soil erosion control has been attempted (Dougal, 1970).

Data and Methods

Most of the data used in the Skunk River water quality study was obtained from Iowa State University, which has conducted studies on the South Skunk River in the Ames area since the mid 1960's. Surveys of the entire river have only recently been undertaken with one study by the State Hygienic Laboratory in the fall of 1974, and another study by the DEQ in February, 1975. A permanent sampling location near Mount Pleasant has been sampling quarterly since August, 1972. The data from Iowa State University, while geographically limited, provides good information on the effect of the Ames treatment plant discharge on the river.

Water Quality Conditions

Harmful Substances - Both DDE and dieldrin concentrations have exceeded the maximum recommended concentrations established by the National Academy of Science. DDE concentrations in those samples where it was detected have averaged 0.22 ug/l with a maximum concentration of 1.82 ug/l. Dieldrin concentrations have averaged 14 ng/l with a maximum of 76 ng/l. Similar concentrations, and in some cases even higher than these, have been found in Indian Creek, a major Skunk River tributary. All of the results are on samples collected in or near Story County. The pesticide concentrations found are assumed to be due to the extensive use of these chemicals on the surrounding agricultural land.

Heavy metals including barium, chromium, copper, lead, manganese, mercury, zinc, and selenium have been found in the Skunk River. Only lead and copper have been found in concentrations exceeding Iowa Water Quality Standards. There are no known heavy metal dischargers on the Skunk River.

TABLE IV-2

HEAVY METALS IN THE SKUNK RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (µg/l)	MAXIMUM (µg/l)
As	12	0		
Ba	8	8	387	900
Cd	11	0		
Cr	13	1	20	20
Cu	11	3	23	50
Pb	11	4	100	150
Mn	11	5	18	40
Hg	5	1	2.2	2.2
Ni	9	0		
Ag	9	0		
Zn	11	9	110	290

TABLE IV-3

HEAVY METALS IN THE SOUTH SKUNK RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (µg/l)	MAXIMUM (µg/l)
As	2	0		
Ba	4	4	125	200
Cd	4	0		
Cr	6	0		
Cu	4	0		
Pb	4	2	10	10
Mn	0	0		
Hg	2	0		
Ni	2	0		
Ag	0	0		
Zn	4	4	30	50
Se	1	1	3	3

TABLE IV-4

PESTICIDES IN THE SKUNK RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (ng/l)	MAXIMUM (ng/l)
DDE	26	18	219	1820
DDT	8			
Dieldrin	28	28	14	76
Atrazine	18	18	797	3900

TABLE IV-5

PESTICIDES IN THE INDIAN CREEK / SKUNK RIVER

PARAMETER	TOTAL SAMPLES	NUMBER OF SAMPLES WITH DETECTABLE LEVELS	MEAN OF THOSE WITH DETECTABLE LEVELS (ng/l)	MAXIMUM (ng/l)
DDE	15	15	408	3920
Dieldrin	15	15	15	71
Atrazine	15	15	42	3652

With the lack of a definite point source it has been assumed that nonpoint source runoff accounts for the metals. Further study of the presence of lead and copper appears necessary.

Physical Modification - Turbidity is the most significant problem involving physical modification on the Skunk River. Sediment loading is the largest mass contribution of pollutants from agricultural sources. Various estimates have been made regarding the sediment yield from agricultural land to the Skunk River. Estimates for the Ames area range from 0.6 to 2.0 tons per acre. This lies between the extremes for sediment runoff for Iowa streams of about 0.95 tons per acre on the East Fork Hardin Creek to 17 tons per acre per year in the Soldier River near Pisgah. Field observations after flood periods have shown that stream clarity returns in seven to ten days, in which time visibility will return to a depth of one to two feet (Dougal, 1970).

Oxygen Depletion - Point source discharges from municipalities could create serious dissolved oxygen and ammonia problems on the Skunk River. Data are sufficient to verify this in the case of Ames. Violations of Iowa Water Quality Standards in the Ames area have been noted less frequently since 1970 than in the 1960's. This is probably due as much to high flows since 1970 as to any increase in treatment efficiency from point sources.

Information concerning diurnal oxygen fluctuations, oxygen sags below point sources, ammonia concentrations under ice cover and low flows are nonexistent for the majority of the basin. Studies around Ames have given an adequate picture of water quality, but do not provide information on the effects further downstream. Recent surveys by the State Hygienic Laboratory and the Department of Environmental Quality (DEQ) are only a beginning in attempts to understand reaeration, nitrification, and algal activity under ice cover or low flow conditions.

Mathematical modeling has suggested that ammonia concentrations under low flow conditions during complete ice cover may violate Iowa Water Quality Standards along the entire stream during low flows. Additionally, dissolved oxygen violations are likely to occur. Recent surveys under ice cover at average flow conditions have not found dissolved oxygen or ammonia violations. Instead, intense algal activity causing super-saturated daytime oxygen concentrations has been found. Even nighttime dissolved oxygen minimums were still far above critical levels. Ammonia concentrations, while somewhat elevated, were not been found in violation of Iowa standards.

While most studies concerning ammonia and dissolved oxygen have been aimed at point source pollution, nonpoint sources may also have an important impact during spring runoff periods. Studies conducted by Jones (1972) included collection of samples from above Story City to Cambridge on the

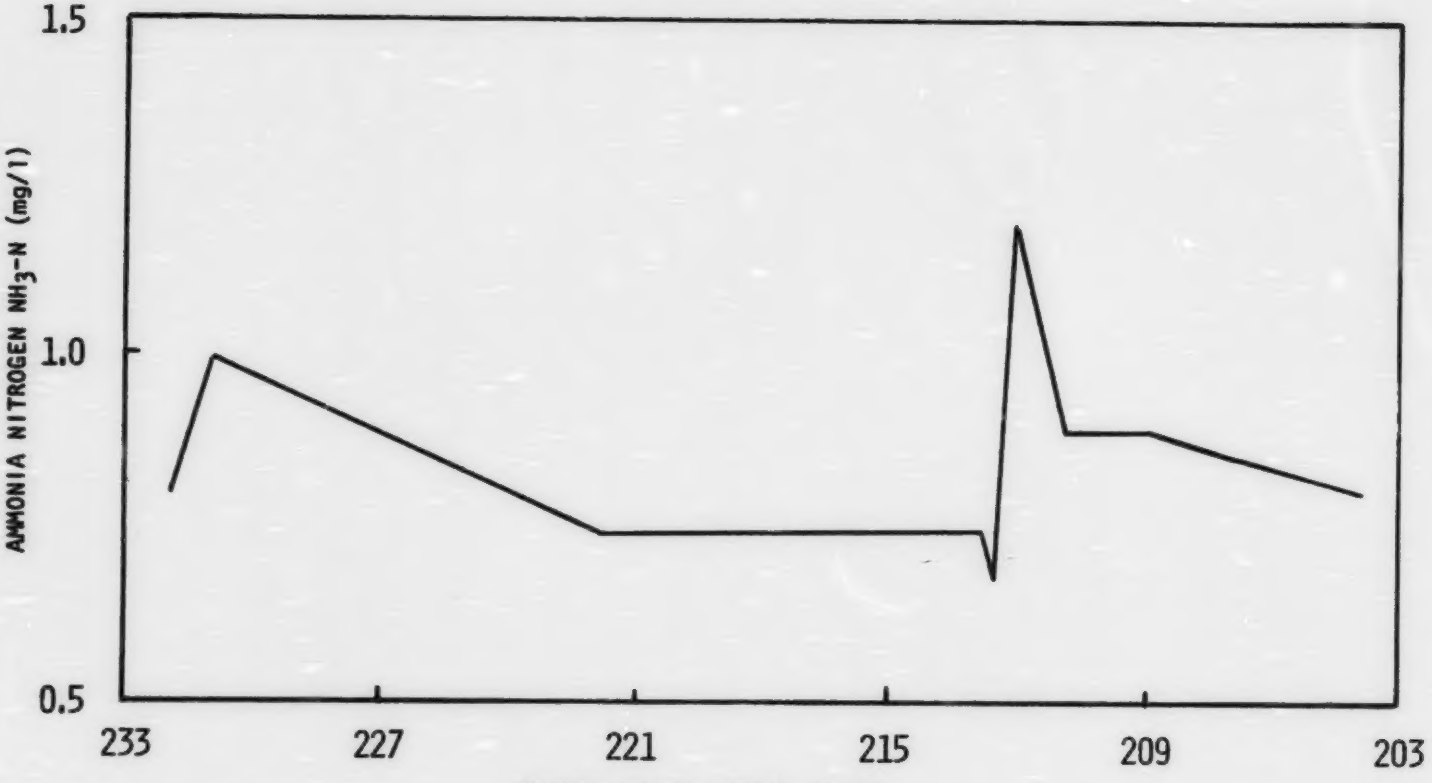


FIGURE IV-4 MEAN AMMONIA CONCENTRATIONS IN THE SOUTH SKUNK RIVER
FEB.-DEC., 1970

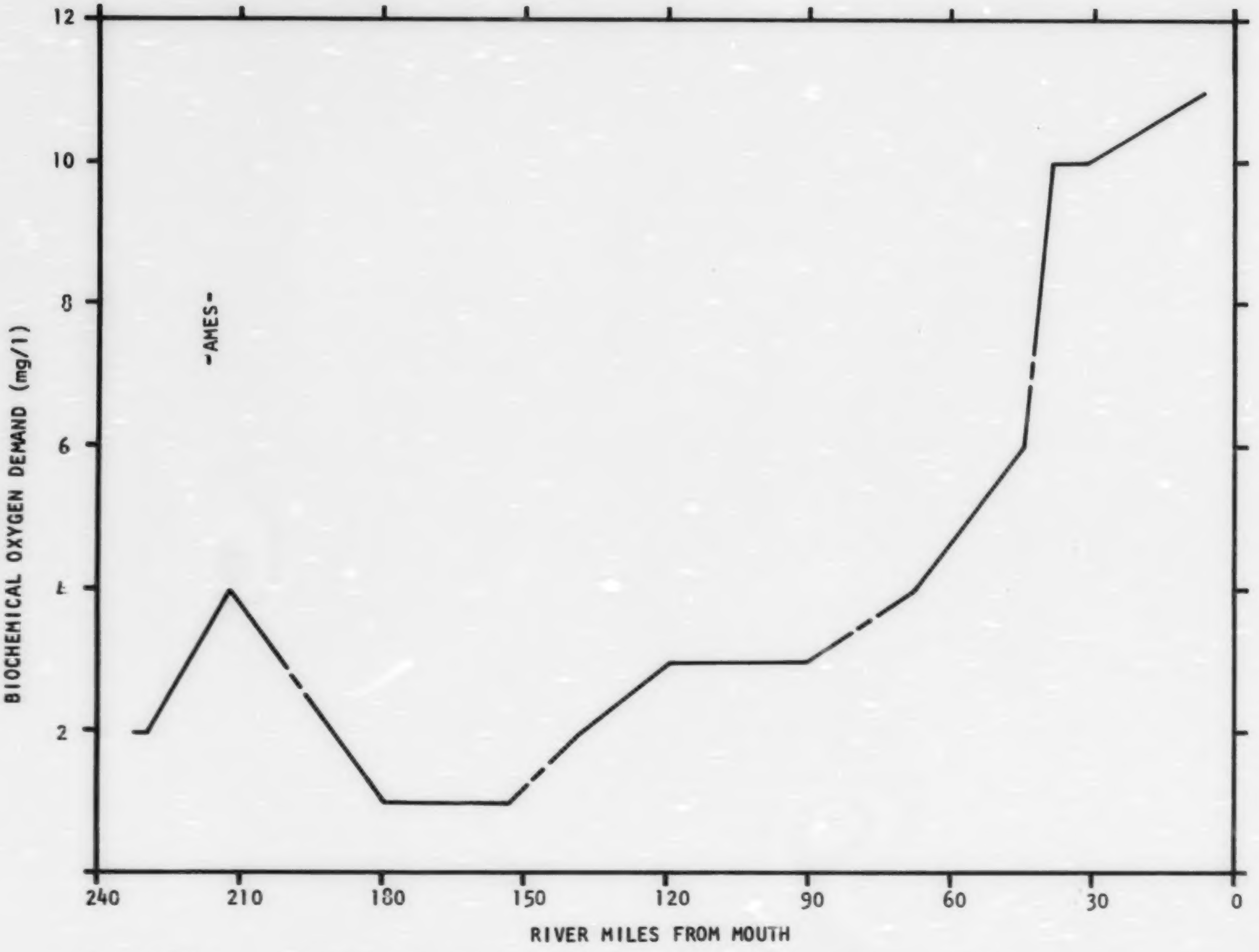


FIGURE IV-5 BIOCHEMICAL OXYGEN DEMAND CONCENTRATIONS IN THE SKUNK RIVER, SEPTEMBER 1974

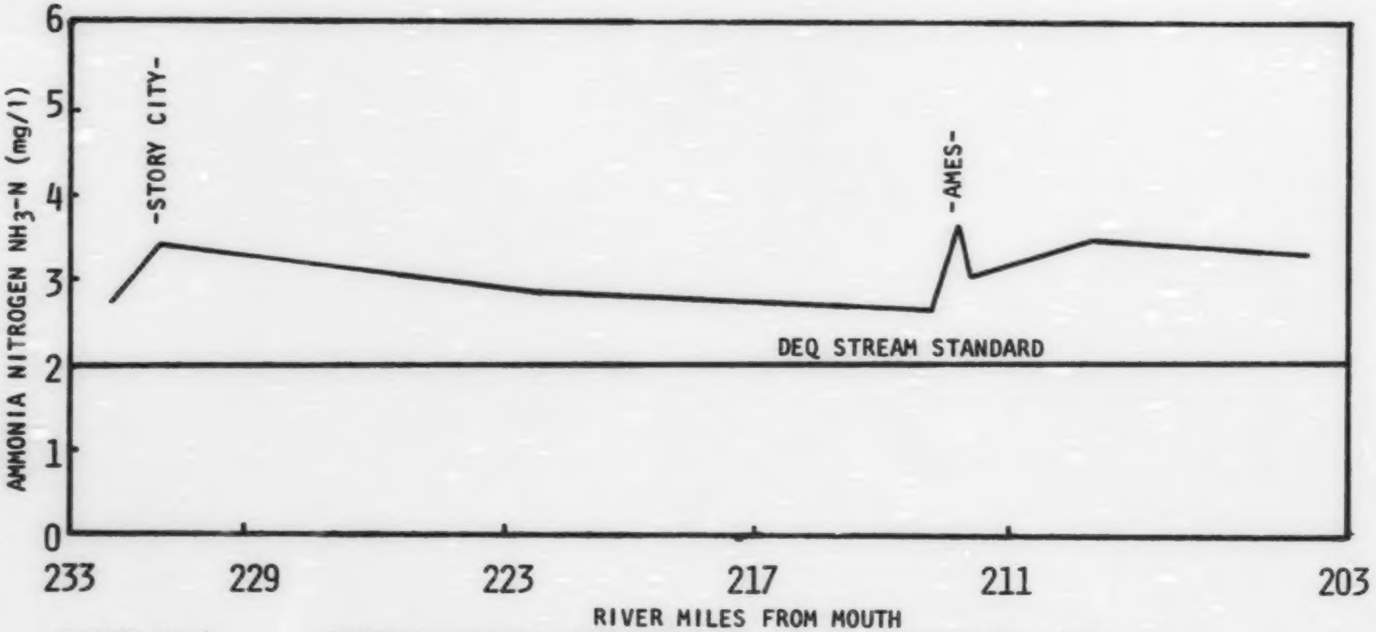


FIGURE IV-6 AMMONIA NITROGEN CONCENTRATIONS IN THE SOUTH SKUNK RIVER, MARCH 4, 1970. FLOW OF 546 cfs AT AMES

South Skunk River. Samples collected during a runoff period in 1970 showed ammonia concentration exceeding Iowa standards over the entire reach. Flow during the sampling period was over 500 cfs at Ames. This flow is exceeded only 10% of the time according to flow duration tables available from USGS for the Ames gauge station. The flow of 546 cfs was exceeded only 12 days during 1970. It is unlikely that a point source could have the impact shown at that flow. The only point sources above Story City are Ellsworth, Randall, and Jewell.

Ammonia pollution from nonpoint sources has not previously been considered a problem. According to Biggar and Corey (1969) (1) ammonium ions are not carried to surface waters in runoff or groundwater flows but are held in cation exchange sites in the soil. Further study to determine the source of the ammonia above Story City is needed.

Health Hazards and Aesthetic Degradation - Only limited data has been collected on fecal or total coliform concentrations in the Skunk River. Those data which are available indicate few problems with high fecal coliform concentrations in the Skunk except below major municipal discharges (Figure IV-7). These bacteria concentrations decrease rapidly downstream due to dilution or cell die off. The effect of nonpoint sources on fecal coliform concentrations is unknown. Data from bordering basins suggest that elevated concentrations occur during runoff periods, resulting in violations of the 200/100 ml criteria established by the EPA. No violations of Iowa Water Quality Standards for fecal coliform have been found.

OTHER TRIBUTARIES

Available water quality data on other tributaries in the Skunk Basin is sparse. Infrequent and random samplings combined with only minimal analyses make any significant evaluation of water quality on other streams in the Skunk Basin impossible.

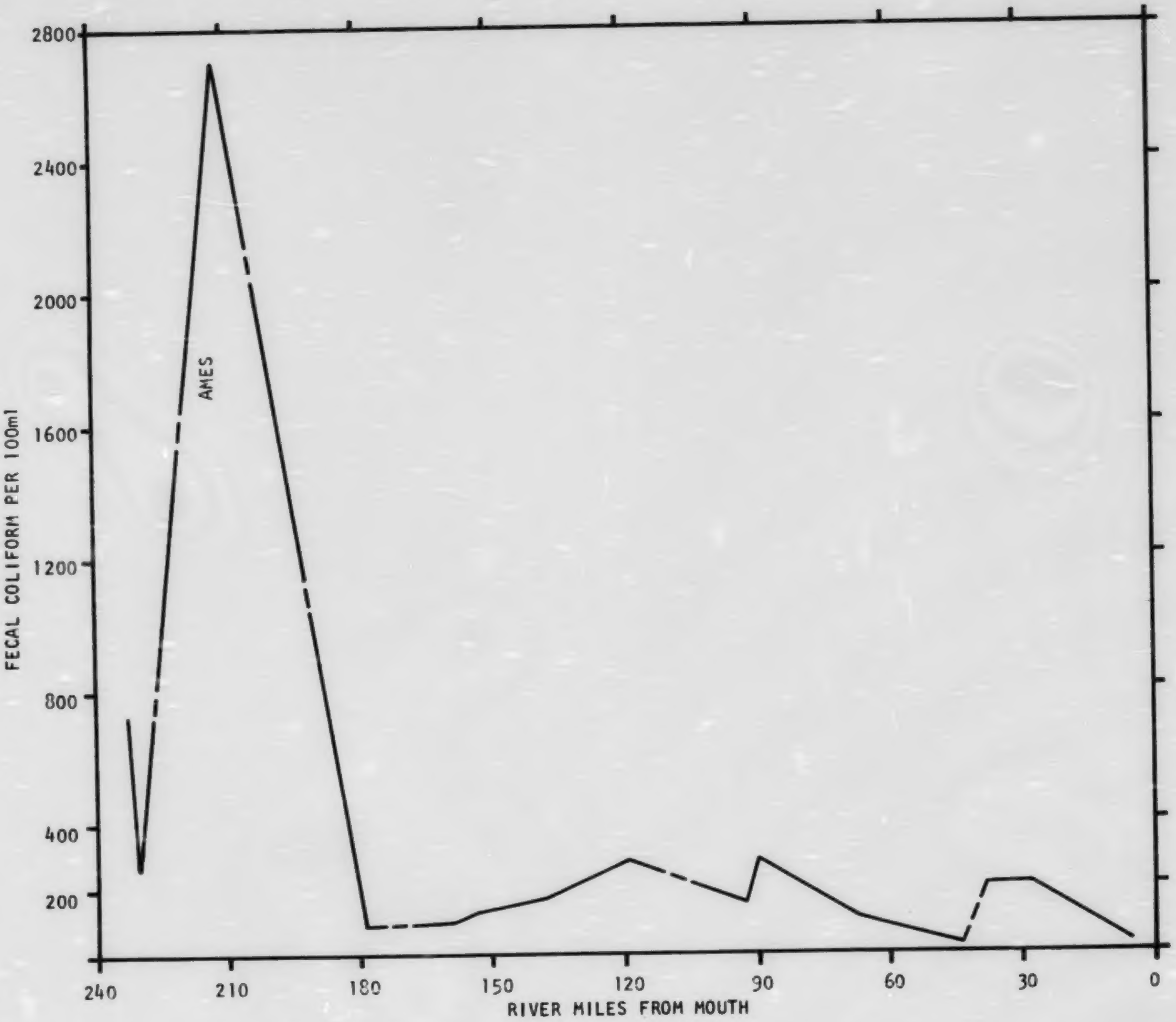


FIGURE IV-7 FECAL COLIFORM CONCENTRATIONS IN THE SKUNK RIVER, SEPTEMBER, 1974

TABLE IV-6

SKUNK RIVER TRIBUTARIES 1974-1975

TRIBUTARY TO SOUTH SKUNK	BOD (mg/1)	FECAL COLIFORM (#/100ml)	TOTAL PHOSPHATE (mg/1)	AMMONIA (mg/1)	NITRATE (mg/1)	TURBIDITY (JTU)	DISSOLVED SOLIDS (mg/1)	CHLORIDE (mg/1)
Indian Creek	2	30	0.07	0.29	3.5	5	382	17
Cherry Creek	4.5	12,000	1.4	1.22	2.4	12	358	22
Sewer Creek	8.8	35,000	5.2	2.7	3.5	22	606	70
Spring Creek	8	1,000	2.6	2.9	2.0	15	606	42
Big Cedar Creek	6	150	0.19	0.01	0.1	22	275	20
Big Creek	10	620	1.2	0.16	1.6	22	589	74
Squaw Creek	5	-	-	0.34	4.4	-	-	-

TRIBUTARY TO SOUTH SKUNK	BOD (mg/1)	FECAL COLIFORM (#1/100ml)	TOTAL PHOSPHATE (mg/1)	AMMONIA (mg/1)	NITRATE (mg/1)	TURBIDITY (JTU)	DISSOLVED SOLIDS (mg/1)	CHLORIDE (mg/1)
Rock Creek (Jasper Co.)	3.3	-	-	0.27	1.3	-	-	-
Moon Creek	4	-	-	0.33	1.0	-	-	-
Sugar Creek	3.3	-	-	0.42	3.7	-	-	-
Middle Creek	4.3	-	-	0.61	3.8	-	-	-
Rock Creek (Keokuk Co.)	3.7	-	-	0.71	2.9	-	-	-

References

1. Biggar, J. W. and R. B. Corey. Eutrophication: Causes, Consequences, Correctives. National Academy of Sciences, Washington, D.C., 1969.

2. Dougal, M. D. "Physical and Economic Factors Associated with the Establishment of Stream Water Quality Standards." Unpublished Ph.D. thesis. Iowa State University, Ames, Iowa, 1969. 1533pp.

3. Jones, J. R. "A Limnological Survey of the Upper Skunk River, Iowa." Unpublished M.S. thesis, Iowa State University, Ames, Iowa, 1972. 149pp.

CHAPTER V - POINT SOURCE DISCHARGE INVENTORY

Municipal, industrial, and semipublic point sources of wastewater, as identified in the DEQ files as discharging to surface waters in the Skunk River Basin, have been inventoried and tabulated. Agricultural and some nonpoint sources are inventoried in Chapter VII.

An alphabetical listing of municipal, industrial, and semipublic wastewater discharges appears in Table V-1. Also included in this table is information concerning the location of each discharge (by county and river mile), and an identification of the receiving stream for each discharge.

A coding system was used in Table V-1, which assigned a reference number to each discharge. Reference numbers for municipal sources are prefixed by "M", industrial sources by "I", and semipublic sources by "S", (all incorporated municipalities have been assigned reference numbers whether they have discharges or not). The reference numbers are used to identify specific existing discharges in Figure V-1 which show the location of point source discharges in the Skunk River Basin. With few exceptions, reference numbers run in a consecutive downstream order beginning at the northern end of the basin.

Table V-1 also cross references information concerning the present characteristics of each discharge, the waste load allocation for each discharge, and an estimate of the municipal cost involved in meeting the allocation.

Table V-2 identifies characteristics of each wastewater point discharge from municipal, semipublic and industrial sources. Beginning with the upstream end of the South Skunk River, dischargers are listed in order proceeding downstream. For each tributary stream, the point source furthest upstream is identified and the tabulation continues downstream to the main channel.

Table V-2 lists present design capacity, present average daily flow, BOD_5 and ammonia nitrogen effluent concentrations, type of treatment processes, method of sludge disposal, and comments, for each discharger. Treatment processes are identified only in general terms. Specific process descriptions can be obtained from the DEQ. The comments section may include information obtained by the DEQ personnel concerning existing operation, age of existing facilities, specific DEQ operation permit requirements, DEQ orders for additional treatment, or a delineation of proposed facilities.

A total of 65 municipal treatment facilities has been identified in the basin. In addition, 29 small communities presently without municipal collection or treatment systems are included in Tables V-1 and V-2.

MUNICIPAL

Municipal sewage flow and operational data for municipalities were extracted from the DEQ records. Average flow values contained in reports submitted by treatment plant operators have been used. Flow values shown in Table V-2 are the averages obtained for the last full year of record; in most instances 1973.

Most effluent quality data were collected from the DEQ's Effluent Quality Analysis Program (EQAP). These data were supplemented by wastewater treatment facility operation reports. Data reported through EQAP are the results of tests conducted by the Iowa State Hygienic Laboratory on wastewater samples supplied by the individual dischargers. In most instances, no more than four BOD_5 values and two ammonia nitrogen values are reported each year. This is due to the fact that a significant portion of the facilities are lagoons that only discharge a few times each year. No samples are required when the facilities are not discharging.

The results of BOD_5 analyses performed by the Iowa State Hygienic Laboratory (reported in EQAP) are reported as being between 25 mg/l and 150 mg/l. For some communities a percentage of the values reported are 25 or "25-" mg/l. Values designated "25-" are less than 25 mg/l, but were assumed to be equal to 25 mg/l for this study. Thus, the actual average effluent BOD_5 concentration may in some cases be lower than that obtained from EQAP information. The adequacy of the program will be reviewed since some dischargers are, or soon will be, required to provide BOD_5 removals to less than 25 mg/l. In some instances, due to a sparsity and scattering of data, engineering judgment was applied to arrive at representative values rather than taking strict averages of the available data.

SEMIPUBLIC

Information identifying semipublic treatment facilities in the study area was obtained from the DEQ files. Description of wastewater discharges from semipublic facilities was difficult due to the minimal surveillance provided. Quantitative and qualitative data were obtained from EQAP reports or design information from the DEQ files. Values in Table V-2 are based on both limited operational data and design characteristics, and may not accurately reflect present operating conditions.

INDUSTRIAL

Information on industries discharging wastewater to streams within the study area was obtained from the U.S. Army Corps of Engineers discharge permit applications (Discharge Permit Program, River and Harbors Act of 1899), the DEQ industrial files, and the National Pollutant Discharge Elimination System (NPDES) permit applications. Although these sources provide the best available discharge information, caution must be exercised in its interpretation since it represents data that has been submitted by the individual industries with very little verification.

SUMMARY

The distribution of hydraulic and organic loads upon the streams in the Skunk Basin from municipal, industrial, and semipublic point sources, is summarized in Table V-3. The relatively small quantity of BOD_5 and ammonia-N discharged by industries and semipublic facilities compared to their flow is due to the following:

1. Several quarries discharge large volumes of water, but add very little BOD_5 to the stream.
2. Several industrial discharges consist only of cooling water; which adds negligible amounts of BOD_5 to the stream.
3. Insufficient monitoring data exist for many of the semipublic and industrial facilities to detect actual quantities.

Table V-4 summarizes the various types of municipal wastewater treatment facilities, the number of facilities, and the population served, for each subbasin. Table V-5 is a summary of treatment types for the entire Skunk River Basin.

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGE POINTS

Discharger	Reference Number	County	River Mile	Discharge To	Page Reference Inventory	Needs
MUNICIPAL					Chapter V	Chapter VIII
Agency	M-76	Wapello	42	Cedar Creek	29	15
Ames	M-11	Story	219	S. Skunk River	16	10
Barnes City	M-50	Poweshiek	--	NEMTF	24	13
Batavia	M-78	Jefferson	42	NEMTF	30	15
Baxter	M-25	Jasper	184	Prairie Creek	18	16
Birmingham	M-96	Van Buren	42	Cedar Creek	31	
Blairsburg	M- 3	Hamilton	243	Drainage Ditch	13	15
Brighton	M-63	Washington	72	Skunk River	27	13
Cambridge	M-14	Story	212	S. Skunk River	17	14
Colfax	M-17	Jasper	187	S. Skunk River	17	11
Collins	M-22	Story	184	Wolf Creek	18	16
Colo	M-20	Story	184	Dye Creek	18	16
Coppock	M-70	Washington	--	NEMTF	28	
Crawfordsville	M-69	Washington	--	NEMTF	28	16
Danville	M-85	Des Moines	8	Long Creek	32	13
Delta	M-54	Keokuk	--	NEMTF	25	13
Elkhart	M-15	Polk	202	S. Skunk River	17	14
Ellsworth	M- 2	Hamilton	246	S. Skunk River	13	15
Fairfield	M-79	Jefferson	42	Cedar Creek	30	12
Fort Madison	M-87	Lee	--	Mississippi River	33	10
Fort Madison - Westerly Lagoon	M-88	Lee	--	Mississippi River	33	13
Franklin	M-90	Lee	--	NEMTF	34	
Fremont	M-75	Mahaska	42	Cedar Creek	29	12
Gilbert	M- 9	Story	220	Keigley Branch	14	15
Grinnell	M-47	Poweshiek	68	Sugar Creek	23	10
Harper	M-60	Keokuk	--	NEMTF	26	15
Hayesville	M-52	Keokuk	--	NEMTF	25	
Hedrick	M-39	Keokuk	114	Sugar Creek	21	14
Hillsboro	M-81	Henry	--	NEMTF	31	14
Houghton	M-89	Lee	--	West Branch Sugar Creek	34	14
Huxley	M-13	Story	211	Ballard Creek	17	10
Jewell	M- 5	Hamilton	243	Drainage Ditch	13	14
Kamrar	M- 4	Hamilton	--	NEMTF	13	15
Kelley	M-12	Story	--	NEMTF	16	14
Kellogg	M-44	Jasper	84	N. Skunk River	22	12
Keokuk-Hazelhurst	M-93	Lee	--	Mississippi River	36	14
Keokuk	M-94	Lee	--	Mississippi River	36	9
Keomah	M-95	Mahaska	--	Lake Keomah State Park System	21	
Keota	M-61	Keokuk	82	Dutch Creek	26	12
Lambs Grove	M-27	Jasper	176	Cherry Creek	19	11
Laurel	M-43	Marshall	--	NEMTF	22	14
Lockridge	M-73	Jefferson	--	NEMTF	29	16
Lynnville	M-46	Jasper	71	N. Skunk River	23	13
Martinsburg	M-40	Keokuk	--	NEMTF	21	
Maxwell	M-21	Story	184	Rock Creek	18	10
McCallsburg	M-19	Story	184	Drainage Ditch #36	17	16
Melbourne	M-42	Marshall	96	Unnamed Creek	22	11
Mingo	M-23	Jasper	184	Indian Creek	18	16
Monroe E.	M-33	Jasper	169	Buck Creek	20	10
Montezuma	M-49	Poweshiek	49	Moon Creek	24	13
Montrose	M-92	Lee	--	Mississippi River	35	14

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGE POINTS

Discharger	Reference Number	County	River Mile	Discharge To	Page Reference Inventory	Page Reference Needs
					Chapter V	Chapter VIII
Mt. Pleasant	M-83	Henry	26	Big Creek	31	11
Mt. Union	M-66	Henry	--	NEMTF	28	16
Nevada	M-18	Story	184	W. Branch Indian Creek	17	11
New London	M-84	Henry	26	Big Creek	31	11
New Sharon	M-51	Mahaska	36	Middle Creek	24	11
Newton NW	M-26	Jasper	176	Cherry Creek	19	10
Newton S	M-31	Jasper	176	Sewer Creek	20	10
Newton SW	M-28	Jasper	176	Cherry Creek	19	9
Newton W	M-29	Jasper	176	Cherry Creek	19	13
Newton E	M-30	Jasper	176	Cherry Creek	19	12
Olds	M-68	Henry	--	NEMTF	28	16
Ollie	M-41	Keokuk	--	NEMTF	22	14
Oskaloosa NE	M-37	Mahaska	137	Spring Creek	21	12
Packwood	M-77	Jefferson	42	Coon Creek	29	15
Pella NE	M-35	Marion	156	Thunder Creek	20	9
Pella NW	M-34	Marion	156	Thunder Creek	20	10
Pleasant Plain	M-72	Jefferson	--	NEMTF	29	
Randall	M- 6	Hamilton	--	NEMTF	14	
Reasnor	M-32	Jasper	172	S. Skunk River	20	12
Rhodes	M-24	Marshall	184	Clear Creek	18	16
Richland	M-62	Keokuk	--	NEMTF	27	15
Roland	M- 8	Story	230	Bear Creek	14	15
Rome	M-74	Henry	--	NEMTF	29	
Rose Hill	M-38	Mahaska	--	NEMTF	21	
Salem	M-82	Henry	29	Fish Creek	31	13
Searsboro	M-48	Poweshiek	--	NEMTF	24	
Sigourney-East	M-57	Keokuk	12	Bridge Creek	26	11
Sigourney-West	M-56	Keokuk	12	Rock Creek	25	12
South English	M-59	Keokuk	--	NEMTF	26	13
Stanhope	M-10	Hamilton	220	Squaw Creek	15	12
Stockport	M-80	Van Buren	--	NEMTF	31	14
Story City	M- 7	Story	237	S. Skunk River	14	11
Sully	M-45	Jasper	73	Slater Creek	23	13
Thornburg	M-55	Keokuk	--	NEMTF	25	
University Park	M-36	Mahaska	137	Spring Creek	21	11
Valeria	M-16	Jasper	--	NEMTF	17	
Washington	M-65	Washington	62	W. Fork Crooked Creek	27	10
Wayland	M-71	Henry	57	Unnamed Creek	29	15
Webster	M-58	Keokuk	--	NEMTF	26	
West Chester	M-64	Washington	--	NEMTF	27	16
West Point	M-91	Lee	--	Devil's Creek	34	13
What Cheer	M-53	Keokuk	17	Coal Creek	25	11
Williams	M- 1	Hamilton	271	Drainage Ditch No. 64	13	15
Winfield	M-67	Henry	62	E. Fork Crooked Creek	28	12
INDUSTRIAL						
Acco Cable Controls	I-30	Jefferson	42	Cedar Creek	30	
American Metal Climax	I-47	Lee	--	Mississippi River	35	
Ames Laboratory Research Reactor Atomic Energy Commission	I- 6	Story	220	Onion Creek	15	
Armour-Dial, Inc.	I-38	Lee	--	Mississippi River	33	
Atchison, Topeka, & Santa Fe R.R. Co.	I-40	Lee	--	Mississippi River	33	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGE POINTS

Discharger	Reference Number	County	River Mile	Discharge To	Page Reference Inventory Needs	
					Chapter V	Chapter VIII
John H. Breck, Inc.	I-43	Lee	--	Taylor's Slough	33	
Burlington Northern Inc.	I-48	Lee	--	Bloody Run Creek	36	
City of Ames Power Plant	I- 4	Story	222	S. Skunk River	15	
Cargill, Inc.	I-26	Washington	62	Crooked Creek	28	
Chevron Chemical Co.	I-44	Lee	--	Mississippi River	34	
Clow Corporation Plant No. 2	I-12	Mahaska	137	Spring Creek	21	
Consolidated Packing Co. Crandon Mill	I-39	Lee	--	Mississippi River	33	
Dexter Co.	I-31	Jefferson	42	Cedar Creek	30	
Douds Stone, Inc.	I-34	Henry	26	Big Creek	31	
E.I. du Pont de Nemours & Co.	I-42	Lee	--	Taylor's Slough	33	
First Mississippi, Inc.	I-37	Lee	--	Mississippi River	32	
Foote Mineral Co.	I-54	Lee	--	Mississippi River	37	
Frehauf Factory	I-46	Lee	--	Mississippi River	35	
Grinnell-Mutual Reinsurance Co.	I-18	Poweshiek	68	Sugar Creek	24	
Hallett Con. Co.	I- 3	Story	230	S. Skunk River	15	
Hubinger Company	I-51	Lee	--	Soap Creek	36	
Ia. Ammunition Plant	I-36	Des Moines	2	Brush Creek	32	
Kaser Con. Co., Coppock Quarry	I-27	Washington	62	Crooked Creek	28	
Kaser Con. Co., Harper Quarry	I-22	Keokuk	91	Unnamed Creek	26	
Kaser Con. Co., New Sharon Quarry	I-19	Poweshiek	--	North Skunk	24	
Kaser Con. Co. Ollie Quarry	I-14	Keokuk	99	Ditch to South Skunk River	22	
Kaser Con. Co., Oskaloosa Quarry	I-11	Mahaska	137	S. Skunk River	21	
Kaser Con. Co., Sully Quarry	I-16	Jasper	73	Slater Creek	23	
Kaser Con. Co., W. Chester Quarry	I-24	Washington	62	W. Fork Crooked Creek	27	
Keokuk Steel Casting	I-53	Lee	--	Mississippi River	37	
Martin Marietta Corp.	I-13	Keokuk	--	S. Skunk River	21	
Martin Marietta Anderson Quarry	I-28	Jefferson	55	Walnut Creek	29	
Martin Marietta Cambridge Mine	I- 7	Story	211	Ballard Creek	16	
Martin Marietta Delta Quarry	I-20	Keokuk	29	N. Skunk River	25	
Martin Marietta Robertson Quarry	I- 2	Story	228	S. Skunk River	15	
Maytag Dairy Farms, Inc.	I- 8	Jasper	176	Benjamin Creek	19	
Maytag Company Plant No. 1	I- 9	Jasper	176	Cherry Creek	19	
Maytag Company Plant No. 2	I-10	Jasper	176	Cherry Creek	19	
Midwest Carbide Corp.	I-49	Lee	--	Mississippi River	36	
Miracle Recreation Equipment Co.	I-17	Poweshiek	--	--	23	
Mt. Pleasant Public Utilities	I-33	Henry	26	Big Creek	31	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGE POINTS

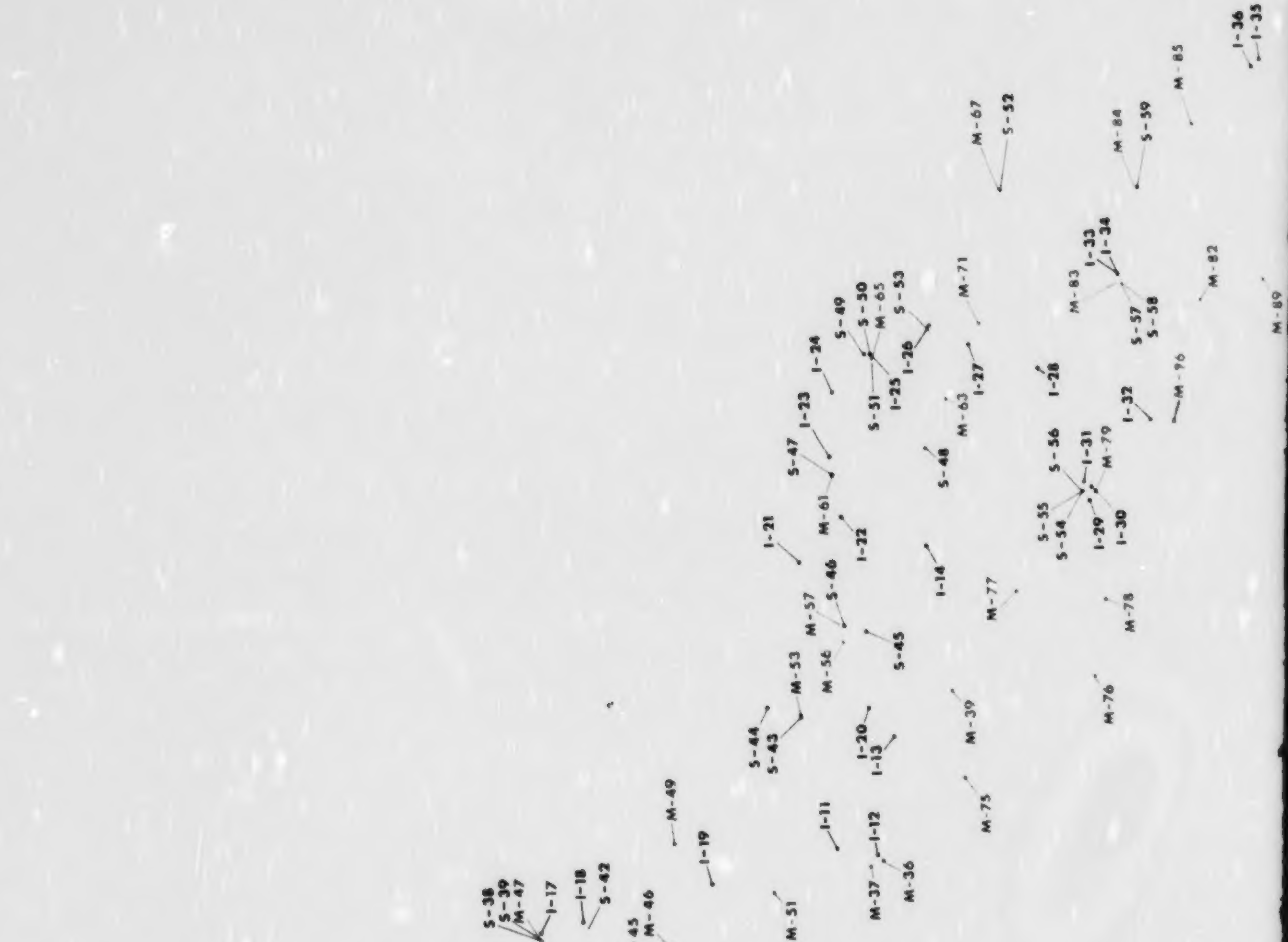
Discharger	Reference Number	County	River Mile	Discharge To	Page Reference Inventory Needs	
					Chapter V	Chapter VIII
Natural Gas Line Co.	I-21	Keokuk	8	German Creek	26	
North American Rockwell Corp.	I-29	Jefferson	42	Mitchell Creek	30	
Raid Quarries Corp. - Cedar Quarry	I-32	Jefferson	42	Cedar Creek	31	
Raid Quarries Corp. - Hawkeye Quarry	I-45	Lee	--	W. Branch Sugar Creek	34	
Raid Quarries Corp. - Hienold Quarry	I-35	Des Moines	2	Unnamed Creek	32	
The River Products Co., Keota Quarry	I-23	Washington	82	Dutch Creek	26	
The River Products Co., Young American Quarry	I-25	Washington	62	W. Fork Crooked Creek	28	
W.A. Sheaffer Pen Company	I-41	Lee	--	Mississippi River	33	
Sheller Globe Corp.	I-50	Lee	--	Soap Creek	36	
Smith-Jones, Inc.	I-15	Jasper	84	North Skunk River	22	
Sundstrand Hydro-Transmission	I- 5	Story	222	S. Skunk River	15	
Union Electric	I-52	Lee	--	Mississippi River	36	
Weaver Con. Co.-Twedt Quarry	I- 1	Hamilton	220	Long Dick Creek	14	
SEMIPUBLIC						
American Oil Co.	S- 2	Hamilton	271	Drainage Ditch #24	13	
American Oil Co.	S-42	Poweshiek	68	Sugar Creek	24	
Ames WTP	S-18	Story	--	--	16	
Anderson MHP	S-66	Lee	--	Mississippi River	35	
Blairsburg WTP	S- 4	Hamilton	243	Drainage Ditch	13	
Bob Welch Truck Stop	S- 1	Hamilton	271	Drainage Ditch #24	13	
Busard Trailer Court	S-63	Lee	--	Drainage Ditch	34	
Chelleen Motel	S-20	Jasper	187	S. Skunk River	17	
Crestview Trailer Park	S-15	Story	220	Squaw Creek	16	
Edgetown MHP	S-28	Jasper	176	Benjamin Creek	19	
Ellsworth WTP	S- 3	Hamilton	246	Skunk River	13	
Esther Estates MHP	S-24	Story	184	Dye Creek	18	
Fairfield WTP	S-54	Jefferson	42	Crow Creek	30	
Fort Madison WTP	S-62	Lee	--	Upper Pen Creek	33	
Geode State Park	S-60	Henry	--	--	32	
Geode State Park	S-61	Henry	--	--	32	
Glenbrook MHP	S-17	Story	220	Worle Creek	16	
Godwin's Colfax MHP	S-21	Jasper	187	S. Skunk River	17	
GM MHP	S-29	Jasper	176	Cherry Creek	19	
Claude Green MHP	S-70	Lee	--	Mississippi River	35	
Green Valley Court, Inc.	S-57	Henry	26	Unnamed Creek	31	
Grinnell WTP	S-39	Poweshiek	68	Sugar Creek	23	
Hickory Grove MHP	S-11	Story	222	S. Skunk River	15	
Hidden Valley MHP	S-51	Washington	62	W. Fork Crooked Creek	27	
Hillsdale MHP	S-10	Story	222	College Creek	15	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGE POINTS

Discharger	Reference Number	County	River Mile	Discharge To	Page Reference Inventory Needs	
					Chapter V	Chapter VIII
The Homestead Colony	S-12	Story	222	Iowa Creek	15	
Huxley WTP	S-19	Story	--	Ballard Creek	16	
Iowa Hwy Commission Rest Area #007R (Grinnell)	S-40	Jasper	68	Sugar Creek	23	
Iowa Hwy Commission Rest Area #008R (Grinnell)	S-41	Jasper	68	Sugar Creek	24	
Iowa Hwy Commission Rest Area #019R (Ames)	S- 8	Story	230	Bear Creek	14	
Iowa Hwy Commission Rest Area #020R (Ames)	S- 9	Story	230	Bear Creek	14	
Iowa State Univ. Physical Plant	S-16	Story	220	Squaw Creek	16	
Jasper County Home	S-32	Jasper	156	Elk Creek	20	
Jefferson County Home	S-55	Jefferson	42	Cedar Creek	30	
Jewell - School	S- 6	Hamilton	243	Drainage Ditch	14	
Jewell WTP	S- 5	Hamilton	243	Drainage Ditch	13	
Kellogg WTP	S-33	Jasper	--	--	22	
Keokuk County Home	S-46	Keokuk	12	Bridge Creek	26	
Keokuk WTP	S-71	Lee	--	Mississippi River	36	
Keota WTP	S-47	Keokuk	82	Dutch Creek	26	
Kings Terrace MHP	S-14	Boone	220	Squaw Creek	16	
Lake Darling State Park	S-48	Washington	--	--	27	
Lake Keomah State Park	S-72	Mahaska	--	South Skunk River	21	
Lake Trio Homeowner Assn., Inc.	S-53	Washington	62	Crooked Creek	28	
Lee County Home	S-67	Lee	--	Drainage Ditch	35	
Linn Hollow MHP	S-50	Washington	62	W. Fork Crooked Creek	27	
Mardan MHP	S-58	Henry	26	Big Creek	31	
McCallsburg WTP	S-23	Story	184	E. Branch Indian Creek	17	
Mingo WTP	S-25	Jasper	184	Indian Creek	18	
Nevada WTP	S-22	Story	184	W. Branch Indian Creek	17	
Newburg Elementary School	S-38	Poweshiek	68	Sugar Creek	23	
New London WTP	S-59	Henry	26	Big Creek	31	
Nickerson Farms #14	S-26	Jasper	--	--	18	
Pella Municipal Power Plant	S-31	Marion	156	Thunder River	20	
Phillips Mobile Village	S-68	Lee	--	Price Creek	35	
Riverview Release Center	S-30	Jasper	176	Cherry Creek	20	
Rock Creek State Park	S-34	Jasper	81	Rock Creek	22	
Rock Creek State Park	S-35	Jasper	81	Rock Creek	22	
Rural Subdivision & MHP	S-56	Jefferson	42	Cedar Creek	30	
Scenic View MHP	S-65	Lee	--	Mississippi River	35	
Sigourney WTP	S-45	Keokuk	12	N. Skunk River	25	
Skelly	S-27	Jasper	184	Fullington Creek	18	
Skyview MHP	S-69	Lee	--	Price Creek	35	
Stanhope WTP	S-13	Hamilton	220	Squaw Creek	15	
Story City WTP	S- 7	Story	237	S. Skunk River	14	

TABLE V-1
POINT SOURCE
WASTEWATER DISCHARGE POINTS

Discharger	Reference Number	County	River Mile	Discharge To	Page Reference	
					Inventory Chapter V	Needs Chapter VIII
Sully-Lynville Community School	S-36	Jasper	73	Slater Creek	23	
Sully School for Christian Training	S-37	Jasper	--	N. Skunk River	23	
Tri-County School	S-44	Keokuk	12	Rock Creek	25	
Washington County Home	S-49	Washington	62	W. Fork Crooked Creek	27	
West Point WTP	S-64	Lee	--	Devil's Creek	34	
What Cheer WTP	S-43	Keokuk	17	Coal Creek	25	
Winfield WTP	S-52	Henry	62	E. Fork Crooked Creek	28	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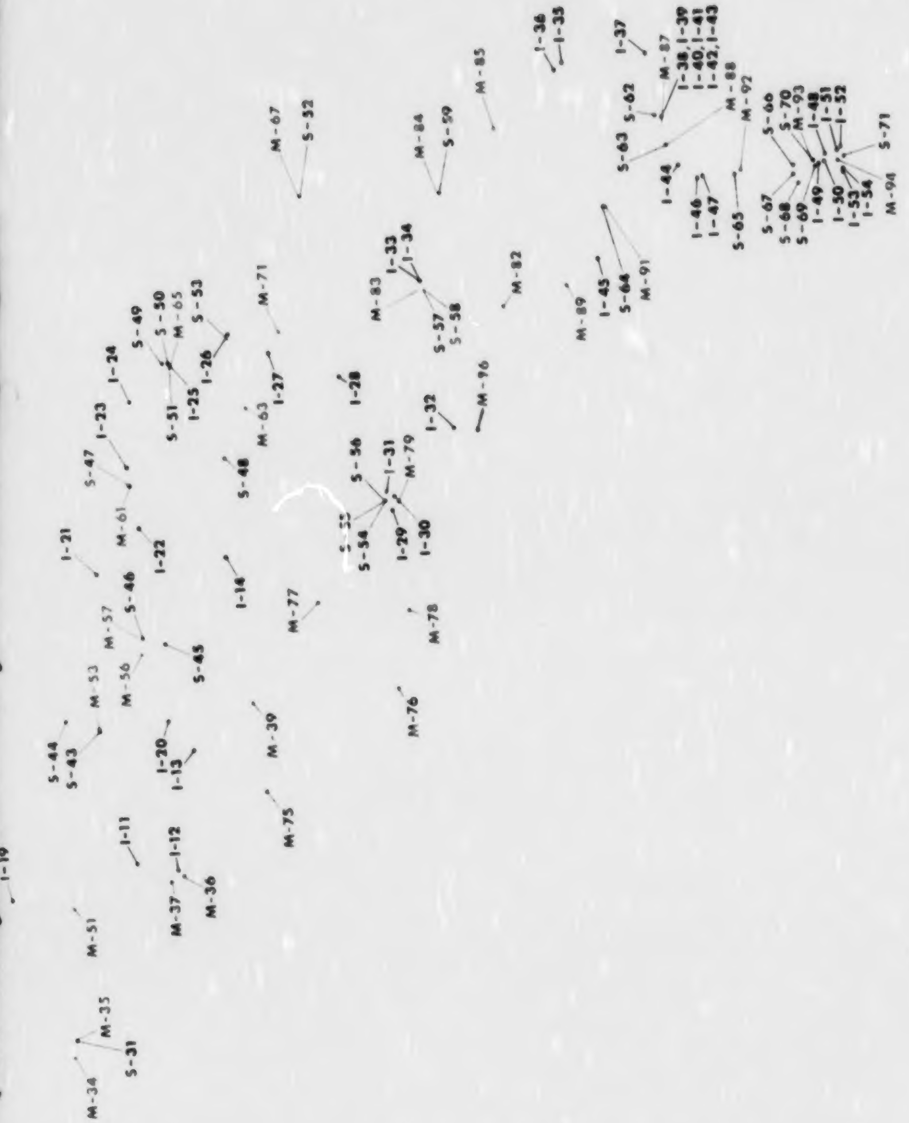
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Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/l)/(lb/day)	 Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
South Skunk River							
Drainage Ditch #64							
Williams M-1	456	590	.053/.120	40/18	20/9	Two Cell Lagoon Not Applicable	
Drainage Ditch #24							
Bob Welch Truck Stop S-1	--	--	--	--	--	Two Cell Lagoon Not Applicable	
American Oil Co. S-2	--	--	--	--	--	Two Cell Lagoon Not Applicable	
South Skunk River							
Ellsworth WTP S-3	--	--	.051/--	--	--	None	Iron and Manganese filter backwash
Ellsworth M-2	443	3216	.209/.212	25/44	10/17	Four Cell Lagoon System Not Applicable	One aerobic lagoon cell for waste from turkey processing
Drainage Ditch							
Blairsburg WTP S-4	--	--	--	--	--	None	Iron filter backwash
Blairsburg M-3	287	450	.033/.045	27/7	15/4	Two Cell Lagoon Not Applicable	
Kamrar M-4	243	--	--	--	--	NEMTF	A waste stabilization lagoon has been proposed
Jewell WTP S-5	--	--	--	--	--	--	
Jewell M-5	1,152	1,100	.081/.073	35/24	20/14	Two Cell Lagoon Not Applicable	10.33 acres. Existing sewers have large quantity of infiltration during period of wet weather

TABLE V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/l)/(lb/day)	 Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Jewell School S-6	--	--	--	--	--	No treatment facilities	
South Skunk River							
Randall M-6	179	--	--	--	--	NEMTF	
Story City WTP S-7	--	--	--	--	--	None	Iron filter & zeolite backwash
Story City M-7	2,104	2,280	.312/.228	35/91	9/24	Imhoff tank, trickling filter Sludge bed, dry haul to farm land	Built 1963
Long Dick Creek							
Weaver Construction Co. I-1	--	--	3.4/--	--	--	None	Quarry dewartering - operate 2 to 4 months every other year
Bear Creek							
Roland M-8	803	--	.036/.051	25/8	15/5	Two Cell Lagoon Not Applicable	
Iowa Highway Commission Rest Area No. 019R S-8	--	--	.003/--	--	--	Two Cell Lagoon Not Applicable	
Iowa Highway Commission Rest Area No. 020R S-9	--	--	.003/--	--	--	Two Cell Lagoon Not Applicable	
Kiegley Branch							
Gilbert M-9	521	512	.052/.074	40/17	8/4	Two Cell Lagoon Not Applicable	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD_5 (mg/l)/(lb/day)	 Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
South Skunk River							
Martin Marietta Robertson Quarry I-2	--	--	.050/--	--	--	None	
Hallett Construction Co. I-3	--	--	1.80/--	--	--		
City of Ames, Power Plant I-4	--	--	.043/--	3/1	0/0	None	Cooling water discharge
Sundstrand Hydro-Transmission I-5	--	--	.015/--	--	--	None	Cooling water discharge
Hillsdale MHP S-10	--	--	--	--	--	Two Cell Lagoon Not Applicable	.87 acres
Hickory Grove MHP S-11	--	--	.001/--	25/.2	20/.17	Septic tank Wet haul to farm land	
The Homestead Colony S-12	--	--	--	--	--	One Cell Lagoon Not Applicable	
Squaw Creek							
Stanhope WTP S-13	--	--	--	--	--	None	Iron filter backwash
Stanhope M-10	482	--	.041/.057	43/15	20/7	Two Cell Lagoon Not Applicable	4.24 acres - built 1970
Onion Creek							
Ames Laboratory Research Reactor Atomic Energy Commission I-6	--	--	--	--	--	None	Cooling water discharge

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Squaw Creek							
Kings Terrace MHP S-14	--	--	.008/--	40/3	--	Extended Aeration w/ polishing pond Not Applicable	To be connected to City of Ames Municipal System at some future date.
Crestview Trailer Park S-15	--	--	--	30/--	--	Aerated Lagoon Not Applicable	.51 acres
Iowa State University Physical Plant S-16	--	--	.41/--	2/2	0/0	None	Cooling water discharge
Worle Creek							
Glenbrook MHP S-17	--	--	--	--	--	One Cell Lagoon Not Applicable	
South Skunk River							
Ames WTP S-18	--	--	--	--	--	No discharge Sludge lagoon	
Ames M-11	39,505	48,000	4.85/5.50	48/1,942	17/688	Trickling filter Liquid lagoon, sludge drying bed, dry haul to farm land	
Kelley M-12	235	--	--	--	--	NEMTF	
Ballard Creek							
Martin Marietta Cambridge Mine I-7	--	--	.05/--	--	--		
Huxley WTP S-19	--	--	.0075/--	--	--	None	Iron and Manganese filter and Zeolite backwash

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Huxley M-13	1,377	882	.112/.068	38/36	25/23	Imhoff Tank, Trickling filter Sludge bed, dry haul to farm land	Built 1959
South Skunk River							
Cambridge M-14	661	600	.061/.066	32/16	1/.5	Two Cell Lagoon Not Applicable	Built 1970
Elkhart M-15	269	312	.013/.031	40/4	20/2	Two Cell Lagoon Not Applicable	
Valeria M-16	96	--	--	--	--	NEMTF	
Chelleen Motel S-20	--	--	--	--	--	Two Cell Lagoon, Total retention Not Applicable	
Godwin's Colfax MHP S-21	--	--	.020/--	--	--	One Cell Lagoon Not Applicable	
Colfax M-17	2,293	3,600	.127/.235	25/27	20/21	Imhoff tank trickling filter Open drying beds, dry haul to farm land	Built 1958
West Branch Indian Creek							
Nevada WTP S-22	--	--	.470/--	--	--	None	Iron filter backwash
Nevada M-18	4,952	4,960	.435/.496	25/91	14/51	trickling filter Wet haul to farm land, drying bed	Built 1930
East Branch Indian Creek							
McCallsburg WTP S-23	--	--	--	--	--	None	Iron filter backwash
Drainage Ditch #36							
McCallsburg M-19	307	400	--/.040	--	--	Two Cell Lagoon Not Applicable	New Plant - 1974

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
Dye Creek							
Colo M-20	606	650	.040/.041	51/17	25/8	Two Cell Lagoon Not Applicable	Built 1968
Esther Estate MHP S-24	--	--	--	--	--	One Cell Lagoon Not Applicable	
Indian Creek							
Maxwell M-21	758	480	.066/.120	40/22	20/11	Imhoff tank, trickling filter Drying bed, dry haul to farm land	Built 1953
Wolf Creek							
Collins M-22	404	650	.024/.032	28/6	15/3	Two Cell Lagoon Not Applicable	
Indian Creek							
Mingo WTP S-25	--	--	.002/--	--	--	None	Iron filter backwash
Mingo M-23	260	350	.025/--	31/7	20/4	Two Cell Lagoon Not Applicable	
Clear Creek							
Rhodes M-24	347	--	.035/--	--	--	Three Cell Lagoon Not Applicable	Built 1973
Fullington Creek							
Nickerson Farms #14 S-26	--	--	--	--	--	Total retention lagoon Not Applicable	
Skelly S-27	--	60	--	--	--	One Cell Lagoon Not Applicable	
Prairie Creek							
Baxter M-25	788	720	.068/.072	35/20	20/11	Two Cell Lagoon Not Applicable	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/1)/(1b/day)	Ammonia-N (mg/1)/(1b/day)		
Benjamin Creek							
Edgetown MHP S-28	--	--	--	27/--	--	One Cell Lagoon Not Applicable	Twenty units
Maytag Dairy Farms, Inc. I-8	--	--	.0044/--	500/18.7	18/1	Septic tank lagoon Not Available	
Cherry Creek							
Newton NW M-26	860	1,910	.173/.218	38/55	20/29	Imhoff tank, trickling filter open drying beds, dry haul to farm	Built 1932
Lambs Grove M-27	239	234	.010/.044	35/3	10/2	Imhoff tank, trickling filter drying bed, dry haul to farm land	Built 1927
Newton SW M-28	1,973	3,000	.263/.5	35/77	25/55	Imhoff tank, trickling filter Open drying beds, dry haul to farm land	Built 1932
Newton W M-29	375	950	.014/.095	28/3	6/1	Two Cell Lagoon Not Applicable	Built 1966
Newton E M-30	178	450	.040/.045	37/12	15/5	Two Cell Lagoon Not Applicable	Built 1970
GM MHP S-29	--	--	--	--	--		Has permit for construction of new waste stabilization lagoon
Maytag Plant No. 1 I-9	--	--	.2/--	7/12	0/0	None	Cooling waster discharge
Maytag Plant No. 2 I-10	--	--	.05/--	22/9	0/0	None	Cooling water discharge

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/l)/(lb/day)	 Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Riverview Release Center S-30	250	--	--	30/--	--	Two Cell Sludge Not Applicable	2.5 acres
Sewer Creek							
Newtor S M-31	12,233	22,500	2.17/3.1	25/452	10/181	Trickling filter Open drying beds, & direct land application (wet)	Built 1955
South Skunk River							
Reasnor M-32	284	285	0.024/.018	38/8	--	Two Cell Lagoon Not Applicable	Built 1967
Buck Creek							
Monroe E. M-33	1,389	1,200	.087/.072	54/39	25/18	Imhoff tank, trickling filter Drying haul to farm land, drying bed	Built 1951
Thunder Creek							
Pella NW M-34	788	1,500	--/.150	26/32.5	20/25	Imhoff tank, trickling filter Drying bed, dry haul to farmland	
Pella NE M-35	5,880	--	1.058/1.12	41/362	25/220.6	Imhoff tank, trickling filter drying bed, dry haul	Two plants are connnected in parrellel
Pella Municipal Power Plant S-31	--	--	.070/--	--	--	None	Cooling tower and boiler blowdown - 4.5 ppm Chromium
Elk Creek							
Jasper County Home S-32	--	--	--	27/--	--	One Cell Lagoon Not Applicable	Latest data, 1964

Table IV-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/1)/(lb/day)	Effluent Ammonia-N (mg/1)/(lb/day)	Treatment Type Sludge Disposal	Comments
South Skunk River							
Kaser Construction Co. Oskaloosa Quarry I-11	--	--	.360/--	--	--		Plant not in operation during winter months
Spring Creek							
University Park M-36	534	225	.054/--	32/14	10/5	Septic tank aerated lagoon Not Applicable	
Oskaloosa NE M-37	11,224	10,500	.980/.400	10/327	5/41	Trickling filter Vacuum filter, raw to sanitary land fill	
Clow Corp. Plant No. 2 I-12	--	--	.013/--	--	--	None	Cooling water discharge
South Skunk River							
Lake Keomah State Park S-72	--	--	.0284/--	--	--	Imhoff tank - sand filter	
Keomah M-95	58					To Keomah State Park Sewer System	(See S-72)
Rose Hill M-38	192	--	--	--	--	NEMTF	
Martin Marietta Corporation I-13	--	--	--	--	--	None	Quarry dewatering
Sugar Creek							
Hedrick M-39	790	910	.035/.909	25/7	15/4	Two Cell Lagoon Not Applicable	
South Skunk River							
Martinsburg M-40	140	--	--	--	--	NEMTF	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Ollie M-41	268	--	--	--	--	NEMTF	
Kaser Construction Company Ollie Quarry I-14	--	--	.134/--	--	--		
North Skunk River							
Unnamed Creek							
Melbourne M-42	661	500	.048/.030	45/18	25/10	Imhoff tank, trickling filter Land Application	Built 1946
Alloway Creek							
Laurel M-43	245	--	--	--	--	NEMTF	
North Skunk River							
Smith-Jones, Inc. I-15	--	--	.071/--	48/28	10/6	None	Metal processing and cooling wastewaters. Heavy metals present. Under consent order new treatment plant building.
Kellogg WTP S-33	--	--	--	--	--	None	
Kellogg M-44	607	820	.023/.100	58/11	30/6	Trickling filter Drying bed	Built 1958
Rock Creek							
Rock Creek State Park S-34	--	--	.047/--	--	--	One Cell Lagoon Not Applicable	
Rock Creek State Park S-35	--	--	.053/--	--	--	One Cell Lagoon Not Applicable	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent: Flow (mgd) Average/Design	Effluent: BOD$_5$ (mg/1)/(1b/day)	Effluent: Ammonia-N (mg/1)/(1b/day)	Treatment Type Sludge Disposal	Comments
Slater Creek							
Kaser Construction Company Sully Quarry I-16	--	--	.053/--	--	--		
Sully M-45	655	3,450	.084/.112	33/23	15/11	Four Cell Lagoon System (One Cell Aerated) Not Applicable	
Sully-Lynnville Community School S-36	--	--	--	25/--	--	Septic tank, trickling filter Not Applicable	Connect to City in near future
Sully School for Christian Training S-37	--	--	--	25/--	--		
Lynnville M-46	381	410	.010/.041	52/4	25/2	Two Cell Lagoon Not Applicable	3.6 acres
Sugar Creek							
Newburg Elementary School S-38	--	--	.0005/--	71/.3	25/.08	Extended Aeration Not Applicable	
Grinnell WTP S-39	--	--	1.655/--			None	Zeolite backwash
Grinnell M-47	8,402	--	1.838/.825	25/383	10/153	Trickling filter Open drying beds, dry & wet haul to farm land	1951 - great increase in growth resulted in increase flow.
Miracle Recreation Equipment Co. I-17	--	--	.002/--	--	--	Septic tank, tiles Not Applicable	Connect to city in near future
Iowa Highway Commission Rest Area No. 007R S-40	--	--	.003/--	38/1	20/.5	Two Cell Lagoon Not Applicable	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/1)/(lb/day)	Ammonia-N (mg/1)/(lb/day)		
Iowa Highway Commission Rest Area No. 008R S-41	--	--	.003/--	38/1	20/.5	Two Cell Lagoon Not Applicable	
Grinnell Mutual Reinsurance Co. I-18	--	--	--	--	--	One Cell Lagoon, Total retention Not Applicable	Overflow only in wet weather
American Oil Co. S-42	--	--	--	--	--	Septic tank Not Applicable	No direct discharge
West Creek							
Searsboro M-48	140	--	--	--	--	NEMTF	
North Skunk River							
Kaser Construction Co. New Sharon Quarry I-19	--	--	--	--	--	None	Quarry dewatering
Moon Creek							
Montezuma M-49	1,353	1,500	.097/.232	25/20	15/12	Three Cell Lagoon Not Applicable	11.71 acres Two cells in parallel
Pleasant Creek							
Barnes City M-50	238	--	--	--	--	NEMTF	
Middle Creek							
New Sharon M-51	944	1,170	.069/.092	35/20	20/12	Trickling filter Dry bed, dry haul	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/l)/(lb/day)	 Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
North Skunk River							
Martin Marietta Delta Quarry I-20	--	--	.050/--	--	--	None	
Hayesville M-52	93	--	--	--	--	NEMTF	
Cedar Creek							
Coal Creek							
What Cheer WTP S-43	--	--	--	--	--	None	Iron filter and Zeolite backwash
What Cheer M-53	868	868	.069/.074	39/22	20/12	Imhoff tank trickling filter Dry bed & dry haul farm	
Cedar Creek							
Delta M-54	475	--	--	--	--	NEMTF	
Rock Creek							
Tri-County School S-44	--	--	--	--	--	Two Septic Tank Unknown	One for Junior High School, other for High School
Thornburg M-55	98	--	--	--	--	NEMTF	
Sigourney W M-56	2,319*	1,250	.095/.108	25/20	10/8	Imhoff tank, trickling filter Sludge bed to land application	Built 1935
North Skunk River							
Sigourney WTP S-45	--	--	.030/--	--	--	None	Iron filter backwash twice weekly

*Cities total population

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Bridge Creek							
Sigourney E. M-57	2,319*	1,280	.100/.108	37/31	20/17	Imhoff tank, trickling filter Sludge bed, land application	Built 1935
Keokuk County Home S-46	--	--	.004/--	--	--	One Cell Lagoon Not Applicable	Latest data 1967
German Creek							
Webster M-58	130	--	--	--	--	NEMTF	
South English M-59	218	--	--	--	--	NEMTF	
Natural Gas Line Co. I-21	--	--	--	--	--	None	Pumping of ground water from storage areas
Skunk River							
Clear Creek							
Harper M-60	405	--	--	--	--	NEMTF	
Kaser Construction Co. Harper Quarry I-22	--	--	.100/--	--	--	None	Quarry is closed during winter
Dutch Creek							
Keota WTP S-47	--	--	--	--	--	None	Zeolite backwash
Keota M-61	707	1,324	.105/.102	43/38	25/22	Imhoff tank, trickling filter	Built 1930 sewers have a large quantity of infiltration during period of wet weather
The River Products Co. - Keota County I-23	--	--	.50/--	1/4	--	None	Quarry dewatering & rock washing

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/l)/(lb/day)	 Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Skunk River							
Richland M-62	595	--	--	--	--	NEMTF	Waste stabilization lagoon has been proposed
Lake Darling State Park S-48	--	--	--	--	--	Two One Cell Lagoons, total retention Not Applicable	There are two systems at the park
Brighton M-63	632	600	.043/.060	39/14	20/7	Imhoff tank - sand filter Open sludge bed, land application	
Crooked Creek							
West Fork Crooked Creek							
West Chester M-64	199	--	--	--	--	NEMTF	
Kaser Construction Co. West Chester Quarry I-24	--	--	.016/--	--	--	None	Quarry closed during winter months (season 80 days a year).
Washington County Home S-49	--	--	--	--	--	Imhoff tank, rock filter	
Linn Hollow MHP S-50	100	--	--	--	--	One Cell Lagoon Not Applicable	
Washington M-65	6,317	5,000	1.058/.500	32/291	20/176	Trickling filter wet haul to land application	
Hidden Valley MHP S-51	--	--	--	--	--	Anerobic dig	15 units - issued a permit to build waste stabilization lagoon

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)		
The River Products Co. Young American Quarry I-25	--	--	--/.320	1/	--	Sedimentation Lagoon Not Applicable	Discharge is surface runoff only
East Fork Crooked Creek							
Mt. Union M-66	173	--	--	--	--	NEMTF	
Winfield WTP S-52	897	--	.0045/--	--	--	None	Iron filter backwash discharged to sewage treatment plant
Winfield M-67	897	1,000	.045/.050	25/10	25/9	Septic tank, trickling filter Sludge drying bed, land application	Built 1967
Olds M-68	206	--	--	--	--	NEMTF	
Crawfordsville M-69	288	--	--	--	--	NEMTF	
Crooked Creek							
Lake Trio Homeowner Assn., Inc. S-53	--	--	.001/--	--	--	Aerated Lagoon Not Applicable	
Cargill I-26	--	--	.282/--	1/2	0/0		Discharge cooled and treated water into the municipal storm sewer.
Coppock M-70	58	--	--	--	--	NEMTF	
Kaser Construction Co. Coppock Quarry I-27	--	--	7.65/--	--	--	None	Quarry dewatering

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/1)/(1b/day)	Effluent Ammonia-N (mg/1)/(1b/day)	Treatment Type Sludge Disposal	Comments
Sugar Creek							
Wayland M-71	702	800	.021/.075	27/5	15/3	Two Cell Lagoon Not Applicable	Built 1967, 5.5 acres
Walnut Creek							
Martin Marietta Anderson Quarry I-28	--	--	.140/--	--	--	None	Quarry dewatering
Burr Oak Creek							
Pleasant Plain M-72	121	--	--	--	--	NEMTF	
Brush Creek							
Lockridge M-73	232	--	--	--	--	NEMTF	
Skunk River							
Rome M-74	135	--	--	--	--	NEMTF	
Cedar Creek							
Fremont M-75	480	596	.048/.045	47/19	25/10	Two Cell Lagoon Not Applicable	Built 1967, 4.5 acres
Buckeye Creek							
Agency M-76	610	967	.061/--	25/13	15/8	Two Cell Lagoon Not Applicable	Newly complted, 1974
Competine Creek							
Coon Creek							
Packwood M-77	157	275	.016/--	25/3	15/2	Two Cell Lagoon Not Applicable	Built 1971

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/1)/(1b/day)	Ammonia-N (mg/1)/(1b/day)		
Rock Creek							
Batavia M-78	525	--	--	--	--	NEMTF	Applied for a permit for construction of a waste stabilization lagoon
Mitchell Creek							
North American Rockwell Corp. I-29	--	--	.080/--	2/1	--	Three Cell Lagoon with oil skimmer Not Applicable	Discharge is cooling & scrubbing process water COD = 53 lbs/day
Cedar Creek							
Crow Creek							
Fairfield WTP S-54	--	--	.050/--	--	--	None	Lime sludge dishcarge. No current treatment for discharge. Proposed treatment facility.
Acco Cable Controls I-30	--	--	.12/--	--	--	None	Cooling water discharge
Fairfield M-79	8,715	--	.729/1.60	27/164	10/61	Trickling filter wet haul - land land application	Built 1968
Dexter Co. I-31	--	--	.025/--	--	--	None	Cooling water discharge
Jefferson County Home S-55	--	--	--	38/--	--	One Cell Lagoon Not Applicable	.52 acres
Rural Sub-division and MHP S-56	--	--	--	--	--		Waste stabilization lagoon proposed in 1966

Table V-2
DISCHARGE INVENTORY

			Effluent				
Discharger (Ref. No.)	1970 Pop.	Design P.E.	Flow (mgd) Average/Design	BOD_5 (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Cedar Creek							
Birmingham M-96	452	--	.014	30/4	15/2	Three Cell Lagoon	2.6 acres
Raid Quarry Co. Cedar Quarry I-32	--	--	.031/--	--	--	None	Quarry dewatering
Stockport M-80	334	--	--	--	--	NEMTF	
Hillsboro M-81	252	--	--	--	--	NEMTF	
Fish Creek							
Salem M-82	458	515	.035/.048	42/12	25/7	Two Cell Lagoon Not Applicable	3 acres
Big Creek							
Mt. Pleasant M-83	7,007	13,500	.988/--	25/206	10/82	Trickling filter wet haul - land application	
Green Valley Court, Inc. S-57	--	--	--	--	--	One Cell Lagoon Not Applicable	MHP has 62 units
Mardan MHP S-58	--	--	.003/--	70/2	25/1	Two Cell Lagoon Not Applicable	MHP has 30 units
Mt. Pleasant Public Utilities I-33	--	--	.001/--	--	--		
Douds Stone Products I-34	--	--	.050/--	--	--	None	Quarry dewatering
New London WTP S-59	--	--	--	--	--	None	Filter backwash, discharge to sewage treatment plant.
New London M-84	1,900	1,500	.254/.115	26/55	10/21	Trickling filter Sludge dry bed, land application	Moretime wet haul

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/1)/(1b/day)	Effluent Ammonia-N (mg/1)/(1b/day)	Treatment Type Sludge Disposal	Comments
Skunk River							
Geode State Park S-60	--	--	--	--	--	Total Retention One Cell Lagoon Not Applicable	
Geode State Park S-61	--	--	--	--	--	Total retention One Cell Lagoon Not Applicable	
Long Creek							
Danville M-85	948	1,235	.103/--	26/22	15/13	Two Cell Lagoon Not Applicable	Built 1973
Brush Creek							
Raid Quarries Corp. Heinold Quarry I-35	--	--	.203/--	--	--		
Iowa Ammunition Plant I-36	--	--	.8/--	--	--	Imhoff tank trickling filter	
Mississippi River							
First Mississippi, Inc. I-37	--	--	*	25/--	--	Complete water recycle system	Cooling tower and boiler blowdown, and sanitary discharge. Wastewater discharge includes cyanide, chromate, nickel and zinc. (P.E. 40,700, Design 6.2 mgd)

*Discharge permitted if rain fall event exceeds 10 year 24 hour storm

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD$_5$ (mg/1)/(1b/day)	Ammonia-N (mg/1)/(1b/day)		
Ft. Madison WTP S-62	--	--	.050/--	--	--	None	Lime sludge and filter backwash
Ft. Madison STP M-87	13,996	40,700	3.516/5.76	133/3900	30/880	Primary settling tank landfill	Building secondary plant, pure oxygen activitated sludge
Armour-Dial, Inc. I-38	--	--	2.0/--	42/700	19/313	Unknown	Treated process water, treated domestic wastewater, untreated cooling water.
Consolidated Packaging Co. Crandon Mill I-39	--	--	.685/--	2000/12,300	--	None	Process wastewater and cooling water discharge.
Atchison, Topeka & Santa Fe Railway Co. I-40	--	--	--	--	--	None	Contaminated storm water runoff from fueling area.
W. A. Sheaffer Pen Co. I-41	--	--	.960/--	--	--	None	Metal processing (plating) wastewater, planning complete treatment of plating rinse wastewater before discharging into Mississippi River.
Taylor Slough							
E. I. duPont deNemours & Co. I-42	--	--	1.3/--	--	--	None	Cooling water and blowdown discharge
John H. Breck, Inc. I-43	--	--	1.2/--	--	--	None	Indirect cooling water
Mississippi River							
Ft. Madison STP Westerly Lagoon M-88	13,996*	2,500	.028/.25	30/7	15/4	Two Cell Aerated Lagoon Not Applicable	2 acres

*Total City population

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent			Treatment Type Sludge Disposal	Comments
			Flow (mgd) Average/Design	BOD_5 (mg/1)/(1b/day)	Ammonia-N (mg/1)/(1b/day)		
Drainage Ditch							
Busard Trailer Court S-63	--	--	--	--	--	Two Cell Lagoon Not Applicable	100 units
Mississippi River							
Chevron Chemical Co. I-44	--	--	60.0	--	2.4/1200	Holding pond	Process wastewater for cooling water discharge holding pond. (40 acres).
Sugar Creek							
West Branch Little Sugar Creek							
Houghton M-89	119	395	.018/.0395	25/4	15/2	Two Cell Lagoon Not Applicable	Built 1968
Raid Quarries Corp. Hawkeye Quarry I-45	--	--	.023/--	--	--	None	Quarry dewatering
Franklin M-90	111	--	--	--	--	NEMTF	
Devils Creek							
West Point WTP S-64	--	--	.003/--	--	--	None	Iron filter backwash, discharge to sewage treatment plant.
West Point M-91	1,464	700	.070/--	25/15	10/6	Imhoff tank, trickling filter Sludge bed land application	Inflow/Infiltration problem

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	 BOD$_5$ (mg/1)/(1b/day)	 Ammonia-N (mg/1)/(1b/day)	Treatment Type Sludge Disposal	Comments
Mississippi River							
Freuhauf Factory I-46	--	--	--/.0125	--	--	Extended aeration total retention Not Applicable	Domestic wastewater
American Metal Climax I-47	--	--	--	--	--	Utility blowdown discharge activated sludge (sanitary waste - 500 gpd)	Schedule for operation, 1975
Scenic View MHP S-65	--	--	--	--	--	One Cell Lagoon Not Applicable	39 units
Montrose M-92	735	1000	.04/.10	25/8	10/3	Extended Aeration, chlorination wet haul - land application	
Anderson MHP S-66	--	--	--	--	--	Lagoon Not Applicable	31 units
Drainage Ditch							
Lee County Home S-67	157	250	--	--	--	One Cell Lagoon Not Applicable	
Price Creek							
Phillips Mobile Village S-68	--	--	0.018/--	--	--	Two Cell Lagoon Not Applicable	13 units
Skyview MHP S-69	--	80	--	--	--	One Cell Lagoon Not Applicable	
Mississippi River							
Claude Green MHP S-70	--	--	--	--	--	Septic tank Unknown	50 units, building total retention lagoon at present

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Keokuk STP Hazelhurst Plant M-93	--	170	.017/.017	25/3.5	10/1.4	Extended aeration Not Applicable	30 homes
Bloody Run Creek							
Burlington Northern, Inc. I-48	--	--	--	--	--	Septic tank Unknown	20 people
Mississippi River							
Midwest Carbide Corp. I-49	--	--	.048/--	--	--	None	Contact Cooling water discharge
Soap Creek							
Sheller Globe Corp. I-50	--	--	.030/--	--	--	None	Spray cooling and holding pond
Mississippi River							
Hubinger Co. I-51	--	--	5.125/--	150/6411	30/1282	None	Contact cooling water and process water discharge
Union Electric I-52	--	--	1.877/--	--	--	None	Discharge plant sump collection water from equipment drain
Keokuk WTP S-71	--	--	3.57/--	--	--	None	Lime sludge discharge under consent order to build waste water treatment
Keokuk Water Pollution Control Plant M-94	14,631	--	3.2/5	300/8006	50/1334	Primary settling tank and disposal two lagoon - dry haul land application	

Table V-2
DISCHARGE INVENTORY

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD$_5$ (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Keokuk Steel Casting I-53	--	--	.264/--	--	--	None	Cooling water & surface runoff discharge
Foote Mineral I-54	--	--	.5/--	--	--	None	Surface and roof drainage, cooling water, water from slag settling pond discharge

** Abbreviations used include:

Ammonia-N = Ammonia-Nitrogen
BOD$_5$ = Five Day Biochemical Oxygen Demand
cfs = Cubic feet per second
COD = Chemical Oxygen Demand
D.D. = Drainage Ditch
D.T. = Detention Time
gal. = gallons
lbs. = pounds
mgd = million gallons per day
mg/l = milligrams per liter
MHP = Mobile Home Park
NA = Not Available

NEMTF = No Existing Municipal Treatment Facility
P.E. = Population Equivalent
Pop. = Population
R. = Range
Ref. No. = Reference Number
S.D. = Sanitary District
Sec. = Section
S.S. = Suspended Solids
STP = Sewage Treatment Plant
T = Township
WTP = Water Treatment Plant

TABLE V-3

SKUNK RIVER BASIN
POINT SOURCE
WASTEWATER DISCHARGE SUMMARY

	Municipal	Semipublic	Industrial
South Skunk River			
Flow (MGD)	11.147	.6019	6.119
% Total Flow	62.4	3.4	34.2
BOD$_5$ (lbs/day)	36,755	5.2	40.7
% Total BOD$_5$	99.4	.1	.5
Ammonia-N (lbs/day)	1,423.1	0.17	1.0
% Total Ammonia-N	99.9	.1	.1
Indian Creek			
Flow (MGD)	65	0.472	-
% Total Flow	58.5	41.5	-
BOD$_5$	143	-	-
% Total BOD$_5$	100	-	-
Ammonia-N (lbs/day)	77	-	-
% Total Ammonia-N	100	-	-
North Skunk River			
Flow (MGD)	2.433	1.796	0.176
% Total Flow	56.5	40.6	2.9
BOD$_5$ (lbs/day)	552	2.3	28.0
% Total BOD$_5$	94.8	0.4	4.8
Ammonia-N (lbs/day)	243	1.08	6.0
% Total Ammonia-N	97.2	0.4	2.4
Lower Skunk River			
Flow (MGD)	1.549	0.003	1.794
% Total Flow	48.8	0.1	51.1
BOD$_5$ (lbs/day)	352	2	4
% Total BOD$_5$	98	0.6	1.4
Ammonia-N (lbs/day)	155	1	-
% Total Ammonia-N	99.4	0.6	-

TABLE V-3 (CONTINUED)

	Municipal	Semipublic	Industrial
Crooked Creek			
Flow (MGD)	1.103	0.006	8.268
% Total Flow	11.8	0.1	88.1
BOD_5 (lbs/day)	301	-	2.0
% Total BOD_5	99.3	-	.7
Ammonia-N (lbs/day)	185	-	-
% Total Ammonia-N	100	-	-
Cedar Creek			
Flow (MGD)	.729	0.05	.176
% Total Flow	76.3	5.2	18.5
BOD_5 (lbs/day)	164	-	-
% Total BOD_5	100	-	-
Ammonia-N (lbs/day)	61	-	-
% Total Ammonia-N	100	-	-
Mississippi River			
Flow (MGD)	6.889	3.642	80.225
% Total Flow	7.6	4.0	88.4
BOD_5 (lbs/day)	11,944	-	19,411
% Total BOD_5	38.0	-	62.0
Ammonia-N (lbs/day)	2,230	-	2,795
% Total Ammonia-N	44.4	-	55.6

TABLE V-4

MUNICIPAL WASTEWATER TREATMENT FACILITY PROCESS SUMMARY BY SUBBASIN

Type of Plant	No. of Facilities	Population Served
South Skunk River		
Two Cell Lagoon	14	7,528
Four Cell Lagoon	1	443
Septic Tank, Aerated Lagoon	1	534
Trickling Filter	3	62,962
Imhoff-Trickling Filter	9	16,903
Total	28	88,370
No Treatment	8	1,411
Indian Creek		
Two Cell Lagoon	4	1,577
Three Cell Lagoon	1	347
Trickling Filter	1	4,952
Imhoff-Trickling Filter	1	758
Total	7	7,634
North Skunk River		
Two Cell Lagoon	1	381
Three Cell Lagoon	1	1,353
Four Cell Lagoon	1	655
Trickling Filter	3	9,953
Imhoff-Trickling Filter	4	4,059
Total	10	16,401
No Treatment	8	1,637
Cedar Creek		
Three Cell Lagoon	1	452
Two Cell Lagoon	3	1,247
Trickling Filter	1	8,715
Total	5	10,414
No Treatment	3	1,111

TABLE V-4 (CONTINUED)

Type of Plant	No. of Facilities	Population Served
Crooked Creek		
Trickling Filter	1	6,317
Septic Tank, Trickling Filter	1	897
Total	2	7,214
No Treatment	5	924
Lower Skunk		
Two Cell Lagoon	3	2,108
Trickling Filter	2	8,907
Imhoff-Trickling Filter	1	707
Imhoff Tank, Sand Filter	1	632
Total	7	12,354
No Treatment	5	1,083
Mississippi River		
Primary Settling Tank	2	28,627
Two Cell Lagoon	2	2,619
Imhoff-Trickling Filter	1	1,464
Extended Aeration	1	170
Extended Aeration, Chlorination	1	735
Total	7	33,615

TABLE V-5

SKUNK RIVER BASIN
MUNICIPAL WASTEWATER TREATMENT
FACILITY PROCESS SUMMARY

Type of Plant	Facilities	Population Served
Trickling Filter	11	101,806
Two Cell Lagoon	27	15,460
Three Cell Lagoon	3	2,152
Four Cell Lagoon	2	1,098
Septic Tank, Aerated Lagoon	1	534
Septic Tank, Trickling Filter	1	897
Imhoff Tank, Sand Filter	1	632
Imhoff Tank-Trickling Filter	16	23,891
Extended Aeration	1	170
Extended Aeration, Chlorination	1	735
Primary Settling Tank	2	28,627
Total	65	176,002
NEMTF*	29	6,166

*No Existing Municipal Treatment Facilities

CHAPTER VI - WASTE LOAD ALLOCATIONS AND RANKING

Using a computer methodology, effluent limitations required for dischargers to meet Iowa Water Quality Standards within the basin were determined. Waste load allocation analyses were performed assuming projected 1990 wastewater discharges at the 7-day, 1-in-10 year low flow under both summer and winter conditions. Analyses were performed on streams classified either A, B, or C with existing wastewater discharges. Some considerations that went into the analysis are discussed below. A detailed description of the computer methodology and the assumptions used can be found in the Supporting Document (1). The final waste load allocations are listed in Table VI-1. The effluent limitations for all dischargers in the Skunk River Basin not appearing in Table VI-1 is either secondary treatment or BPT.

Considerations

Four basic considerations go into the selection of the specific effluent limitations for any given discharge. These involve secondary treatment as defined by the EPA and the DEQ, best practicable control technology currently available (BPT), applicable water quality standards, and Iowa's antidegradation requirement.

Secondary Treatment - The Act requires that all publicly owned treatment works shall, by July 1, 1977, achieve, as

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer				Winter			
			BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)		BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)	
South Skunk River										
Drainage Ditch No. 64										
Williams (M-1)	0	Controlled Discharge								
South Skunk River										
Ellsworth (M-2)	0	Controlled Discharge								
Drainage Ditch										
Blairsburg (M-3)	0	Controlled Discharge								
Jewell (M-5)	0	Controlled Discharge								
Jewell School (S-6)	0	Controlled Discharge								
South Skunk River										
Story City (M-7)	0	0.453	7	26	2	8	7	26	2	8
Long Dick Creek										
Weaver Construction Co. 3/ (I-1)	0.45									
Bear Creek										
Roland (M-8)	0.45	Controlled Discharge								

1/ As given on NPDES permit.
2/ BOD and ammonia discharge quantities should be in accordance with final standard industrial classification, "Best Practicable Waste Treatment Technology."
3/ Quarry dewatering and rock washing. No reported BOD or ammonia. Flow from quarry will be low or zero during low flow periods.
4/ Reported value of existing discharge.
5/ Discharge expected to be connected to city sewerage system.

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/l)/	Summer BOD$_5$ (lbs/day)	Summer Ammonia-N (mg/l)/	Summer Ammonia-N (lbs/day)	Winter BOD$_5$ (mg/l)/	Winter BOD$_5$ (lbs/day)	Winter Ammonia-N (mg/l)/	Winter Ammonia-N (lbs/day)
Iowa State Hwy. Comm. Rest Area No. 019R (S-8)	0.45	Controlled Discharge								
Iowa State Hwy. Comm. Rest Area No. 020R (S-9)	0.45	Controlled Discharge								
Kiegley Branch										
Gilbert (M-9)	0.45	Controlled Discharge								
South Skunk River										
Martin Marietta Robertson 3/ Quarry (I-2)	0.45									
Hallett Construction (I-3) 3/	0.45									
City of Ames Power 2/ Plant (I-4)	0.45	0.043	Cooling Water Discharge							
Sundstrand Hydro-Transmission (I-5) 2/	0.45		Cooling Water Discharge							
Hickory Grove Mobile Home Park (S-11)	0.45	0.001	30	0.25	10	0.1	30	0.25	15	0.1
Hillsdale Mobile Home Park (S-10)	0.45	Controlled Discharge								
The Homestead Colony (S-12)	0.45	Controlled Discharge								

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/1)/(lbs/day)		Summer Ammonia-N (mg/1)/(lbs/day)		Winter BOD$_5$ (mg/1)/(lbs/day)		Winter Ammonia-N (mg/1)/(lbs/day)	
Squaw Creek										
Stanhope (M-10)	0.45	Controlled Discharge								
Kings Terrace Mobile Home Park (S-14)	0.45	0.008 4/	7	.5	2	.1	7	.5	2	.1
Crestview Trailer Park (S-15)	0.45	Controlled Discharge								
Iowa State University 2/ Physical Plant (S-16)	0.45	0.140	Cooling Water Discharge							
Worle Creek										
Glenbrook Mobile Home Park (S-17)	0.45	Controlled Discharge								
South Skunk River										
Ames (M-11)	0.63	9.353	7	546	2	156	7	546	2	156
Ballard Creek										
Martin Marietta 3/ Cambridge Mine (I-7)	8.60									
Huxley (M-13)	8.60	0.163	30	41	10	14	7	10	2	3
South Skunk River										
Cambridge (M-14)	8.76	Controlled Discharge								
Elkhart (M-15)	7.62	Controlled Discharge								

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer				Winter			
			BOD$_5$ (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)		BOD$_5$ (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)	
Chelleen Motel (S-20)	5.59	Controlled Discharge								
Godwin's Colfax M. H. P. (S-21)	5.59	Controlled Discharge								
Colfax (M-17)	5.59	0.300	20	50	2	5	7	18	2	5
West Branch Indian Creek										
Nevada (M-18)	5.41	0.800	20	133	2	13	7	47	2	13
East Branch Indian Creek										
Drainage Ditch #36										
McCallsburg (M-19)	5.41	Controlled Discharge								
Dye Creek										
Colo (M-20)	5.41	Controlled Discharge								
Esther Estates Mobile Home Park (S-24)	5.41	Controlled Discharge								
Indian Creek										
Maxwell (M-21)	5.41	0.096	20	16	2	2	7	6	2	2
Wolf Creek										
Collins (M-22)	5.41	Controlled Discharge								
Indian Creek										
Mingo (M-23)	5.41	Controlled Discharge								

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer				Winter			
			BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)		BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)	
Clear Creek										
Rhodes (M-24)	5.41	Controlled Discharge								
Fullington Creek										
Baxter (M-25)	5.41	Controlled Discharge								
Nickerson Farm #14 (S-26)	5.41	Complete Retention System								
Skelly (S-27)	5.41	Controlled Discharge								
Cherry Creek										
Benjamin Creek										
Edgetown Mobile Home Park (S-28)	5.17	Controlled Discharge								
Maytag Dairy Farms (I-8)	5.17	0.004	13	0.4	10	0.3	13	0.4	15	0.5
Cherry Creek										
Newton Northwest (M-26)	5.17	0.216	7	13	2	4	7	13	2	4
Lambs Grove (M-27)	5.17	0.012	7	.7	2	0.2	7	.7	2	0.2
Newton Southwest (M-28)	5.17	0.191	7	11	2	3	7	11	2	3
Newton West (M-29)	5.17	Controlled Discharge								
Newton East (M-30)	5.17	Controlled Discharge								

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/1)/	Summer BOD$_5$ (lbs/day)	Summer Ammonia-N (mg/1)/	Summer Ammonia-N (lbs/day)	Winter BOD$_5$ (mg/1)/	Winter BOD$_5$ (lbs/day)	Winter Ammonia-N (mg/1)/	Winter Ammonia-N (lbs/day)
GM Mobile Home Park (S-29)	5.17	Controlled Discharge								
Maytag Plant No. 1 (I-9)	5.17	0.200	7	11	1	2	7	11	1	2
Maytag Plant No. 2 (I-10)	5.17	0.050	7	3	1	0.4	7	3	1	0.4
Sewer Creek										
Newton South (M-31)	5.17	2.325	7	136	2	39	7	136	2	39
South Skunk River										
Reasnor (M-32)	7.63	Controlled Discharge								
Buck Creek										
Monroe E. (M-33)	7.42	0.105	7	6	2	2	7	6	2	2
Thunder Creek										
Pella Northwest (M-34)	5.66	0.150	7	9	2	3	7	9	2	3
Pella Northeast (M-35)	5.66	1.746	7	102	2	29	7	102	2	29
Elk Creek										
Jasper County Home (S-32)	7.47	Controlled Discharge								
Kaser Construction Co. 3/ Oskaloosa Quarry (I-11)	7.47									
Spring Creek										
University Park (M-36)	5.11	0.055	7	3	2	1	7	3	2	1
Oskaloosa NE (M-37)	5.11	1.185	7	69	2	20	7	69	2	20
Clow Corp. Plant 2/ No. 2 (I-12)	5.11	0.013	Cooling Water Discharge							

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer				Winter			
			BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)		BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)	
South Skunk River										
Lake Keomah State Park (S-72)	6.73	.028 4/	30	7	10	2	30	7	15	4
Keomah (M-95)	6.73	Discharge to Lake Keomah State Park S-72								
Martin Marietta Corp. 3/ (I-13)	7.03									
Sugar Creek										
Hedrick (M-39)	7.65	Controlled Discharge								
South Skunk River										
Kaser Construction Co. 3/ Ollie Quarry (I-14)	8.35									
North Skunk River										
Unnamed Creek										
Melbourne (M-42)	0	0.063	30	16	10	5	30	16	2	1
North Skunk River										
Smith-Jones, Inc. (I-15) 2/	0.06	0.07	30	18	10	6	30	18	2	1
Kellogg (M-44)	0.06	0.100	30	25	10	8	30	25	2	2
Rock Creek										
Rock Creek State Park (S-34)	0.09	Controlled Discharge								
Rock Creek State Park (S-35)	0.09	Controlled Discharge								
Slater Creek										
Sully (M-45)	0.09	Controlled Discharge								

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer				Winter			
			BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)		BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)	
Sully-Lynnville Consolidated School (S-36)	0.09	0.005	30	1	10	0.4	30	1	15	0.6
Kaser Construction Co. 3/ Sully Quarry (I-16)	0.09									
Lynnville (M-46)	0.09	Controlled Discharge								
Sugar Creek										
Newburg Elementary School (S-38)	0.09	0.0005	30	.13	10	.04	30	.13	15	.06
Grinnell (M-47)	0.09	2.527	13	274	4	84	7	148	2	42
Iowa State Hwy. Comm. Rest Area 007R (S-41)	0.09	Controlled Discharge								
Iowa State Hwy. Comm. Rest Area 008R (S-41)	0.09	Controlled Discharge								
Grinnell Mutual Reinsurance Co. (I-18)	0.09	Total Retention System								
North Skunk River										
Kaser Construction Co. 3/										
Moon Creek										
Montezuma (M-49)	2.62	Controlled Discharge								

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/1)/	Summer BOD$_5$ (lbs/day)	Summer Ammonia-N (mg/1)/	Summer Ammonia-N (lbs/day)	Winter BOD$_5$ (mg/1)/	Winter BOD$_5$ (lbs/day)	Winter Ammonia-N (mg/1)/	Winter Ammonia-N (lbs/day)
Middle Creek										
New Sharon (M-51)	2.62	0.117	30	29	10	10	30	29	2	2
North Skunk River										
Martin Marietta Delta 3/ Quarry (I-20)	2.69									
Cedar Creek										
Coal Creek										
What Cheer (M-53)	2.69	0.080	30	20	10	7	30	20	2	1
Rock Creek										
Sigourney West (M-56)	2.90	0.105	30	26	10	9	30	26	2	2
Bridge Creek										
Sigourney East (M-57)	2.90	0.100	30	25	10	8	30	25	2	2
Keokuk Co. Home (S-46)	2.90	Controlled Discharged								
German Creek										
Natural Gas Line Co. (I-21)	3.73	0.010	30	3	10	1	30	3	15	1
Skunk River										
Clear Creek										
Kasper Construction Co. 3/ Harper Quarry (I-22)										
Dutch Creek										
Keota (M-61)	14.58	0.124	30	31	10	10	30	31	15	16
The River Product Co. 3/ Keota Quarry (I-23)	14.58									

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer BOD$_5$ (mg/l)	Summer BOD$_5$ (lbs/day)	Summer Ammonia-N (mg/l)	Summer Ammonia-N (lbs/day)	Winter BOD$_5$ (mg/l)	Winter BOD$_5$ (lbs/day)	Winter Ammonia-N (mg/l)	Winter Ammonia-N (lbs/day)
Skunk River										
Lake Darling State Park (S-48)	16.02	Total Retention Systems								
Brighton (M-63)	16.52	0.048	30	12	10	4	30	12	15	6
West Fork Crooked Creek										
Kaser Construction Co. 3/ W. Chester Quarry (I-24)	17.03									
Linn Hollow M.H.P. (S-50)	17.03	Controlled Discharge								
Washington (M-65)	17.03	1.360	30	340	10	113	13	147	3	34
Hidden Valley Mobile Home Park (S-51)	17.03	Controlled Discharge								
The River Project Co. 3/ Young America Quarry (I-25)	17.03									
East Fork Crooked Creek										
Winfield (M-67)	17.03	0.100	30	25	10	8	13	11	3	3
Crooked Creek										
Lake Trio Homeowner Assn. (S-53)	17.03	Controlled Discharge								
Crooked Creek										
Cargill, Inc. (I-26) 2/	17.03	0.282								
Kaser Construction Co. 3/ Coppock Quarry (I-27)	17.03									

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer				Winter			
			BOD$_5$ (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)		BOD$_5$ (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)	
Sugar Creek										
Wayland (M-71)	18.56	Controlled Discharge								
Walnut Creek										
Martin Marietta Anderson 3/ Quarry (I-28)	18.36									
Cedar Creek										
Fremont (M-75)	0	Controlled Discharge								
Buckeye Creek										
Agency (M-76)	0	Controlled Discharge								
Competine Creek										
Coon Creek										
Packwood (M-77)	0	Controlled Discharge								
Mitchell Creek										
North American Rockwell 2/ Corp. (I-29)	18.02	0.080								
Cedar Creek										
Crow Creek										
Acco Cable Controls (I-30) 2/	0	Cooling Water Discharge								
Fairfield (M-79)	0	1.600	7	93	2	27	13	173	2	27

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer				Winter			
			BOD_5 (mg/1)/(lbs/day)		Ammonia-N (mg/1)/(lbs/day)		BOD_5 (mg/1)/(lbs/day)		Ammonia-N (mg/1)/(lbs/day)	
Dexter Company (I-31) 2/	1.6	2.025	Cooling Water Discharge							
Jefferson Co. Home (S-55)	2.6	0.005	30	1	10	0.4	30	1	15	0.6
Birmingham (M-96)		Controlled Discharge								
Raid Quarry Co. 3/ Cedar Quarry (32)	2.6									
Fish Creek										
Salem (M-82)	19.03	Controlled Discharge								
Big Creek										
Mt. Pleasant (M-83)	18.47	1.107	30	277	10	92	13	120	2	18
Green Valley Court (S-57)	18.47	Controlled Discharge								
Mardan Mobile Home Park (S-58)		Controlled Discharge								
Mt. Pleasant Municipal 2/ Utilities (I-33)	18.47	0.010								
Douds Stone Products, Inc. 3/ (I-34)										
New London (M-84)	18.47	0.323	30	81	10	27	13	35	2	5
Skunk River										
Geode State Park (S-60)	19.91	Total Retention System								
Geode State Park (S-61)	19.91	Total Retention System								

TABLE VI-1

WASTE LOAD ALLOCATIONS

Discharger (Reference Number)	Stream Flow (MGD)	1990 Discharger (MGD)	Summer				Winter			
			BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)		BOD_5 (mg/l)/(lbs/day)		Ammonia-N (mg/l)/(lbs/day)	
Long Creek										
Danville (M-85)	19.76	Controlled Discharge								
Brush Creek										
Raid Quarries Corp. 3/ Heinold Quarry (I-35)	19.76									
Middletown (M-86)	19.76	0.068	30	17	10	6	30	17	15	9
Iowa Ammunition Plant (I-36)	19.76	0.800	30	200	10	67	13	87	2	13

a minimum, secondary treatment. No municipal discharge is, therefore, allowed an effluent limitation less stringent than secondary treatment. Secondary treatment has been defined by EPA and DEQ as having the following concentrations in the effluent: 30 mg/l BOD_5, 30 mg/l suspended solids; or not less than 85 percent removal of BOD_5 and suspended solids; and 200 most probable number/100 ml fecal coliforms.

BPT - The Act requires that all point sources other than publicly owned treatment works shall, by July 1, 1977, achieve as a minimum, "best practicable control technology currently available" (BPT). No industrial discharge is, therefore, allowed an effluent limitation less stringent than BPT. BPT for various industrial processes is defined by the EPA in their industrial development documents.

Applicable Water Quality Standards - The ultimate reason for requiring any effluent limitation is the protection of water quality. The Iowa Water Quality Standards are designed to ensure a reasonable degree of protection. All discharges are, therefore, required to meet effluent limitations stringent enough to assure that water quality standards will be met. Where secondary treatment or BPT is not sufficient to meet the applicable water quality standards, a higher level of treatment is required.

Antidegradation - A policy on antidegradation has been adopted by the DEQ to assure that in those places where water quality significantly exceeds that of the standards, the present condition shall be maintained. New dischargers locating in areas of high quality water may, therefore, be required to meet effluent limitations more stringent than secondary treatment or BPT, even though a lesser degree of treatment might be sufficient to meet water quality standards.

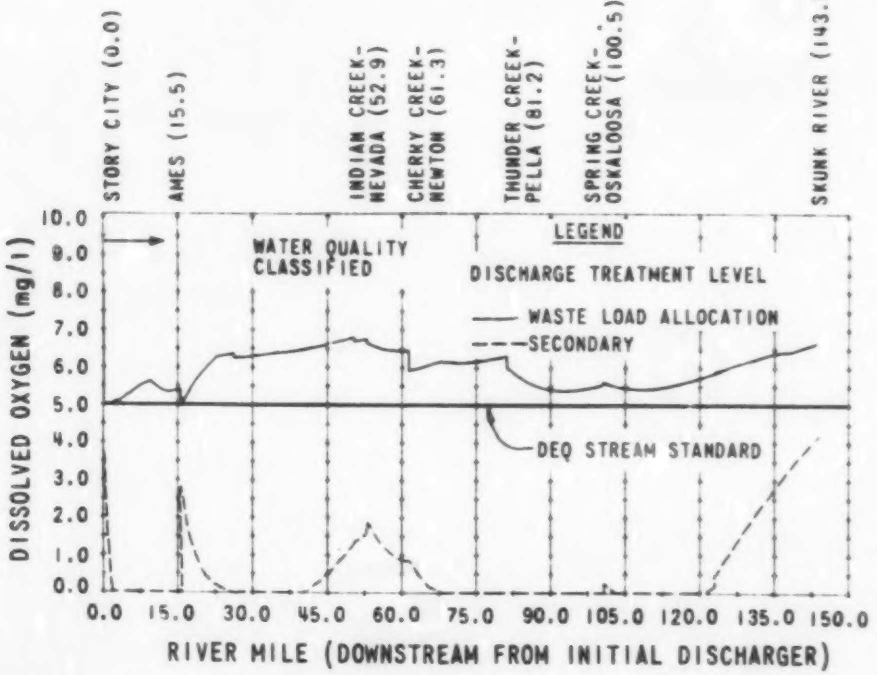
ALLOCATION RESULTS

The waste load allocations are based upon a mathematical model. Based upon the available data, the model predicts stream quality when given the existing wastewater discharges. For the initial simulation, all discharges were assumed to meet either secondary treatment or BPT. Where the model indicated violations of Iowa Water Quality Standards, more stringent effluent limitations were imposed until standards were met. Both winter and summer conditions were evaluated in determining the waste load allocations for the study areas.

Skunk River

Summer Conditions - Dissolved oxygen and ammonia nitrogen concentration profiles for the South Skunk River, North Skunk River, and Skunk River are shown in Figure VI-1, VI-2 and VI-3. The water quality criteria for dissolved oxygen and ammonia nitrogen is met in all sections of the streams which are water quality classified. Dissolved oxygen concentrations will fall below 5 mg/l and ammonia nitrogen

FIGURE VI-1
DISSOLVED OXYGEN AND AMMONIA NITROGEN CONCENTRATION PROFILES, SUMMER CONDITIONS
SOUTH SKUNK RIVER



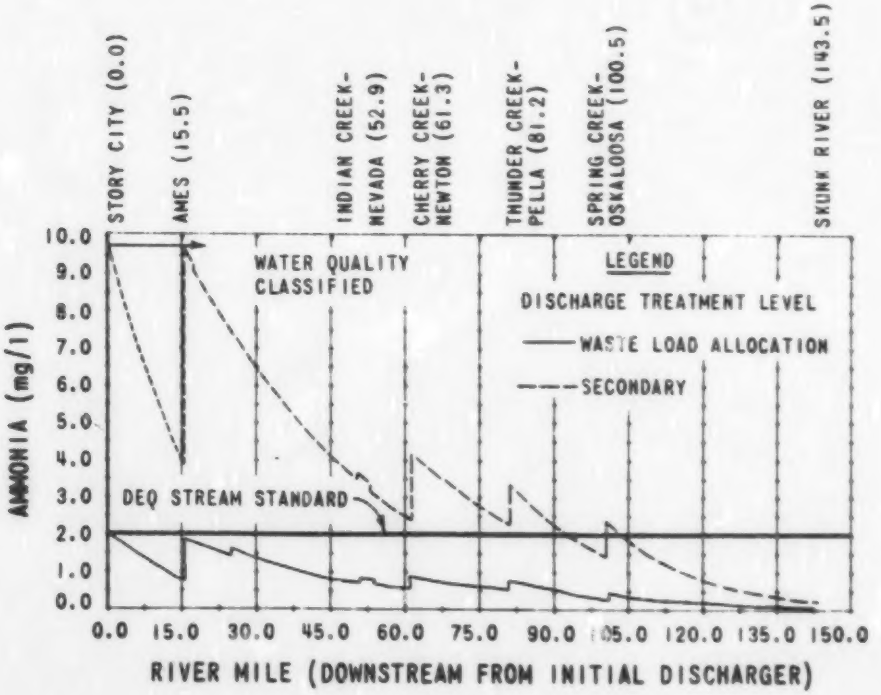
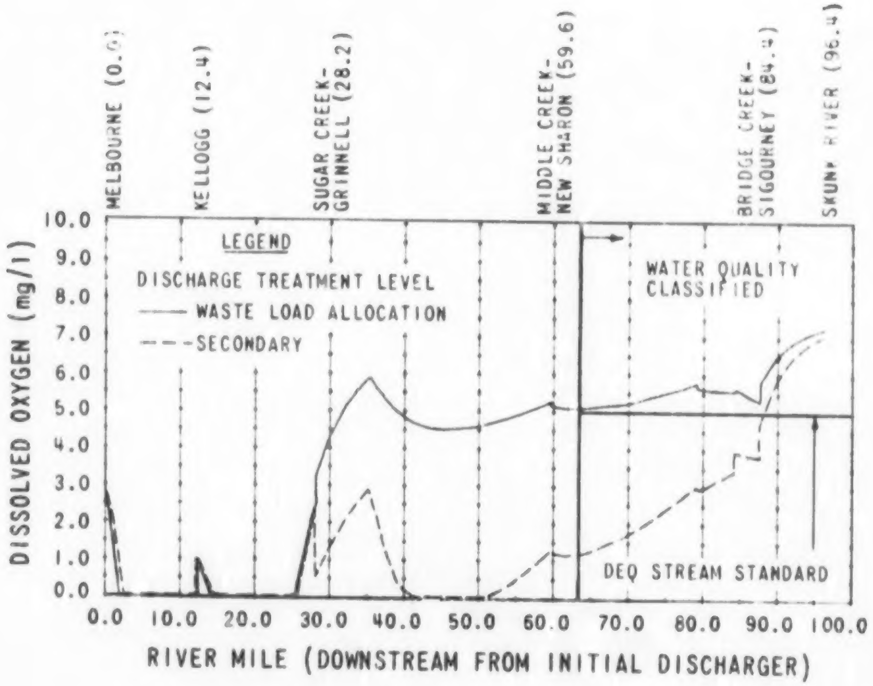


FIGURE VI-2
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATION PROFILES, SUMMER CONDITIONS
NORTH SKUNK RIVER



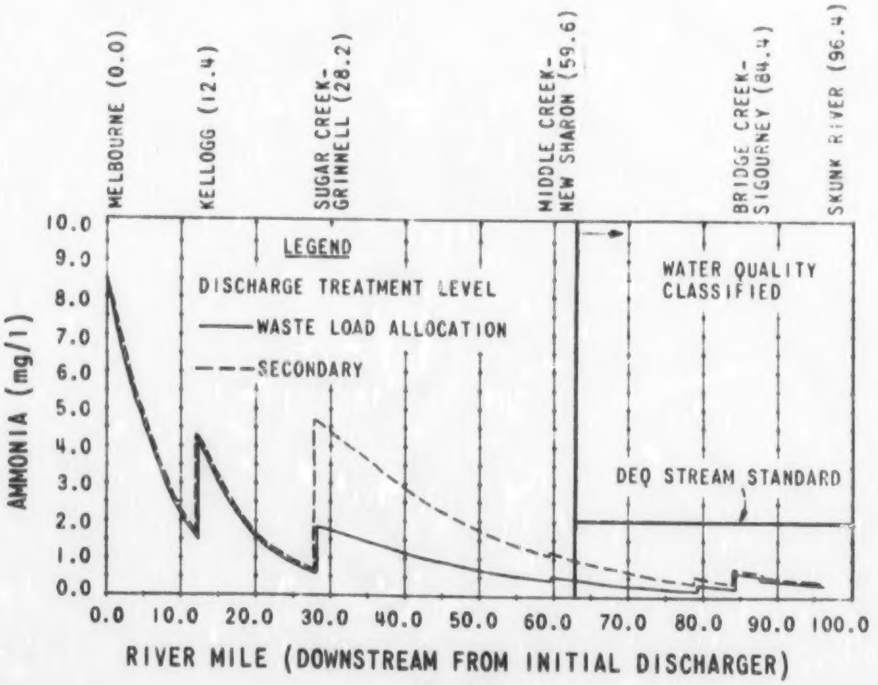
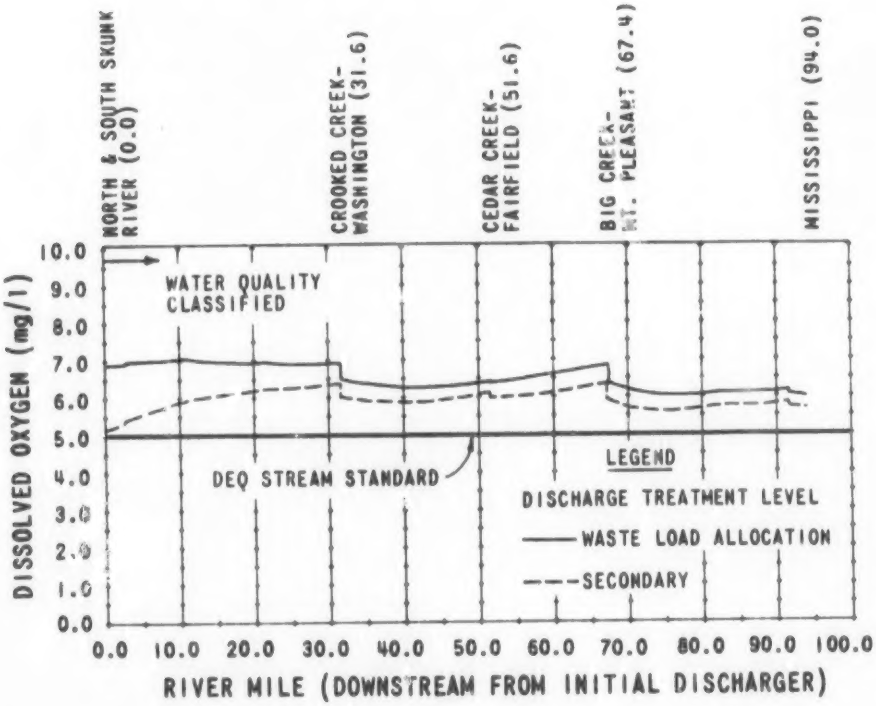
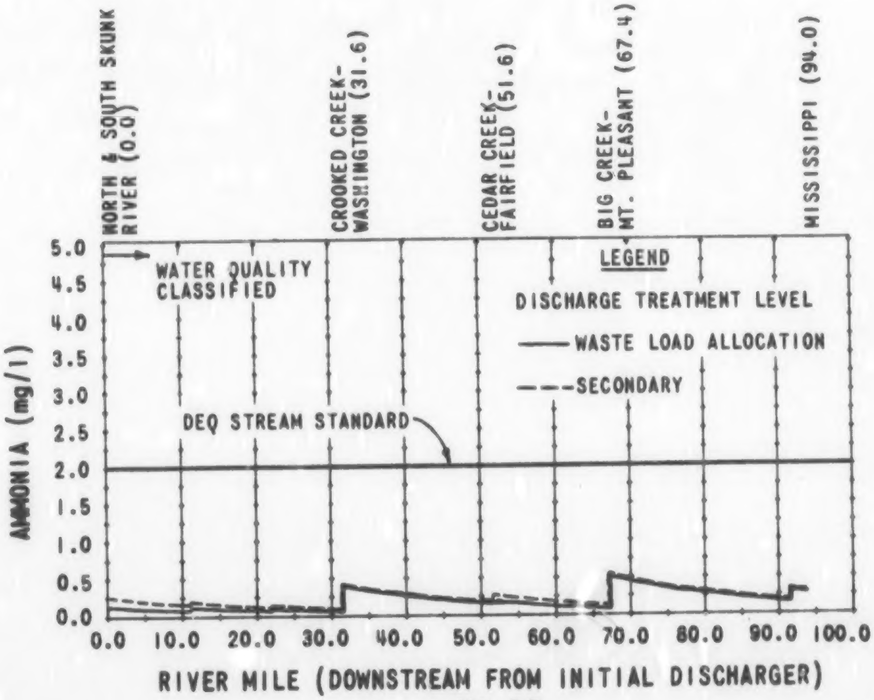


FIGURE VI-3
DISSOLVED OXYGEN AND AMMONIA NITROGEN CONCENTRATION PROFILES, SUMMER CONDITIONS
SKUNK RIVER



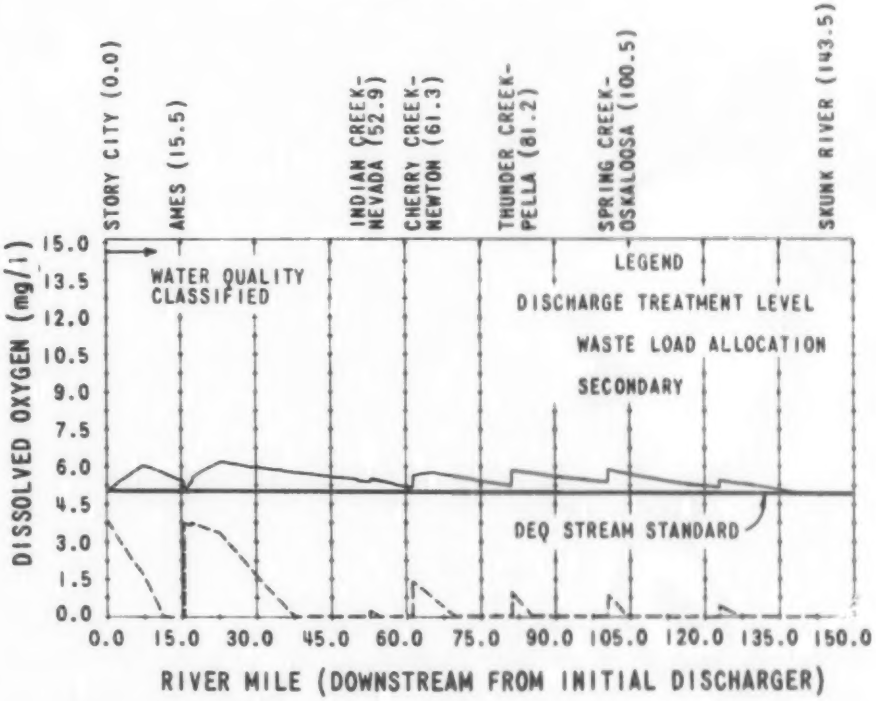


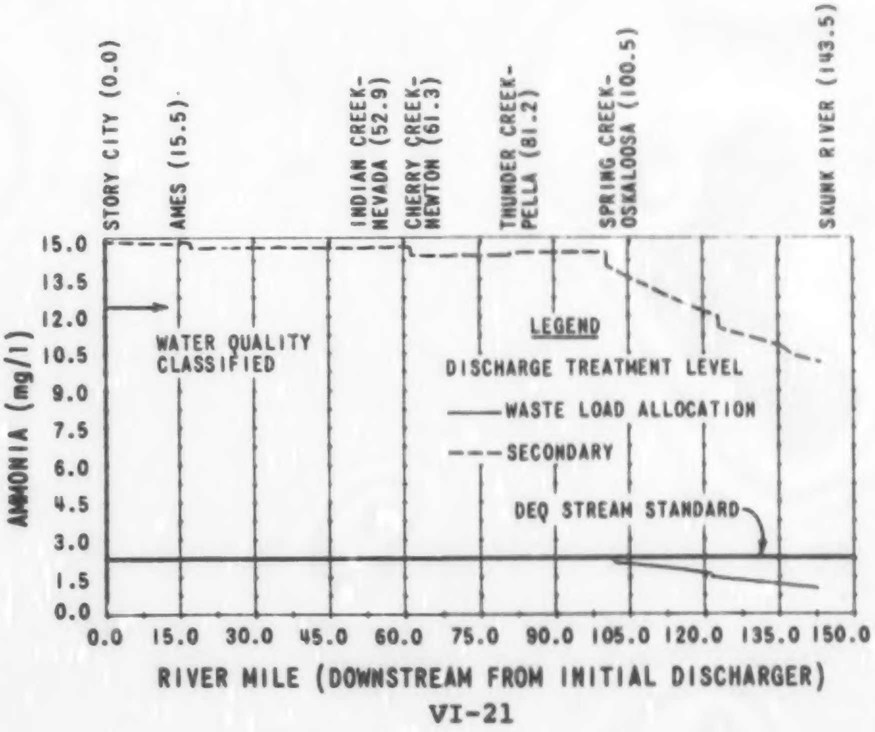
concentrations will rise above 2 mg/l in many of the smaller streams, which are classified during low flow. To meet water criteria under summer conditions, all communities except Huxley and Hedrick which discharge to the South Skunk River or its tributaries must provide a level of wastewater treatment exceeding that of secondary treatment. In addition, the City of Grinnell which discharges to the North Skunk River and the City of Fairfield which discharges into Cedar Creek must also provide a level of treatment exceeding that of secondary treatment. Some form of ammonia removal will be required at the treatment facilities for these communities.

Winter Conditions - Dissolved oxygen concentrations for the South Skunk River, North Skunk River, and the main stem of the Skunk River are shown on Figures VI-4, VI-5 and VI-6. The model shows that for the waste load allocations given in Table VI-1, dissolved oxygen and ammonia nitrogen concentrations meet the water quality criteria in all classified portions of the streams. The dissolved oxygen concentration can be expected to fall below 5 mg/l during low flow conditions in many of the smaller unclassified streams. Reduction of ammonia nitrogen concentrations within the streams is less evident in the winter than the summer because of the lack of bio-oxidation of ammonia at low temperatures.

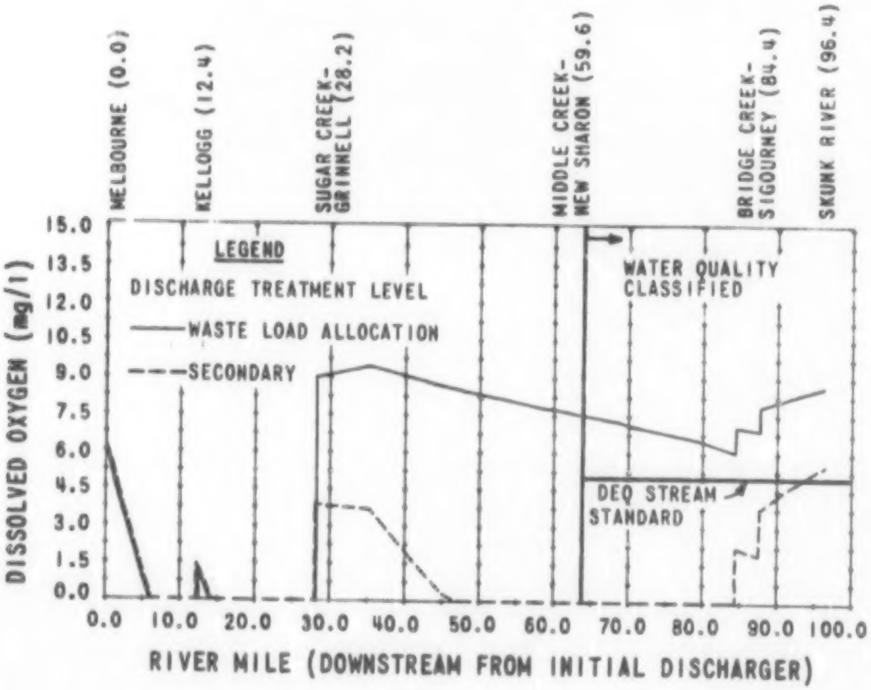
In most cases, the winter allocations are equal to or more restrictive than the summer allocations. Most of the municipalities in the Skunk River Basin which discharge wastewater

FIGURE VI-4
DISSOLVED OXYGEN AND AMMONIA NITROGEN
CONCENTRATION PROFILES, WINTER CONDITIONS
SOUTH SKUNK RIVER





FIGUER VI-5
DISSOLVED OXYGEN AND AMMONIA NITROGEN CONCENTRATION PROFILES, WINTER CONDITIONS
NORTH SKUNK RIVER



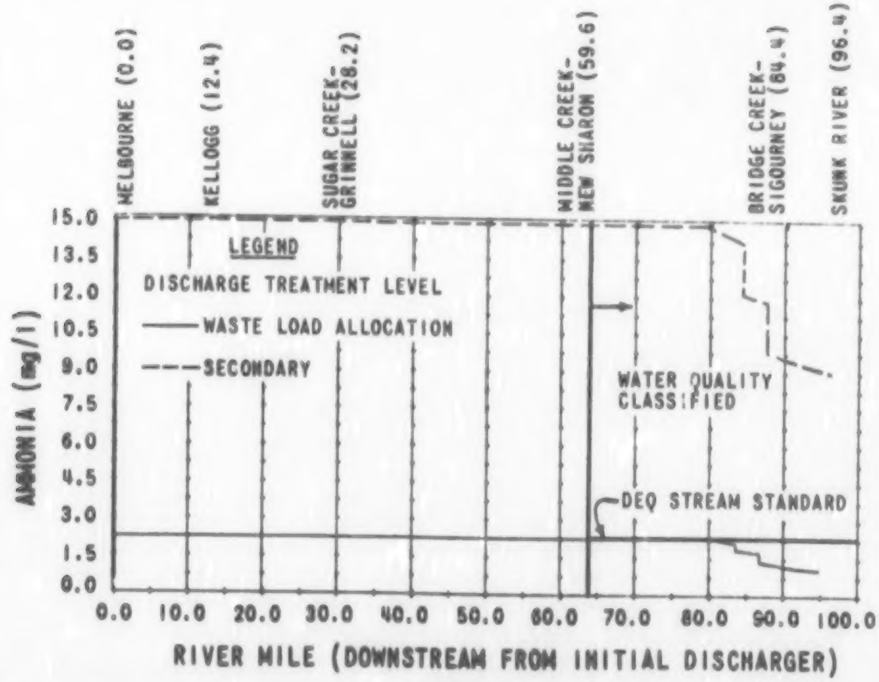
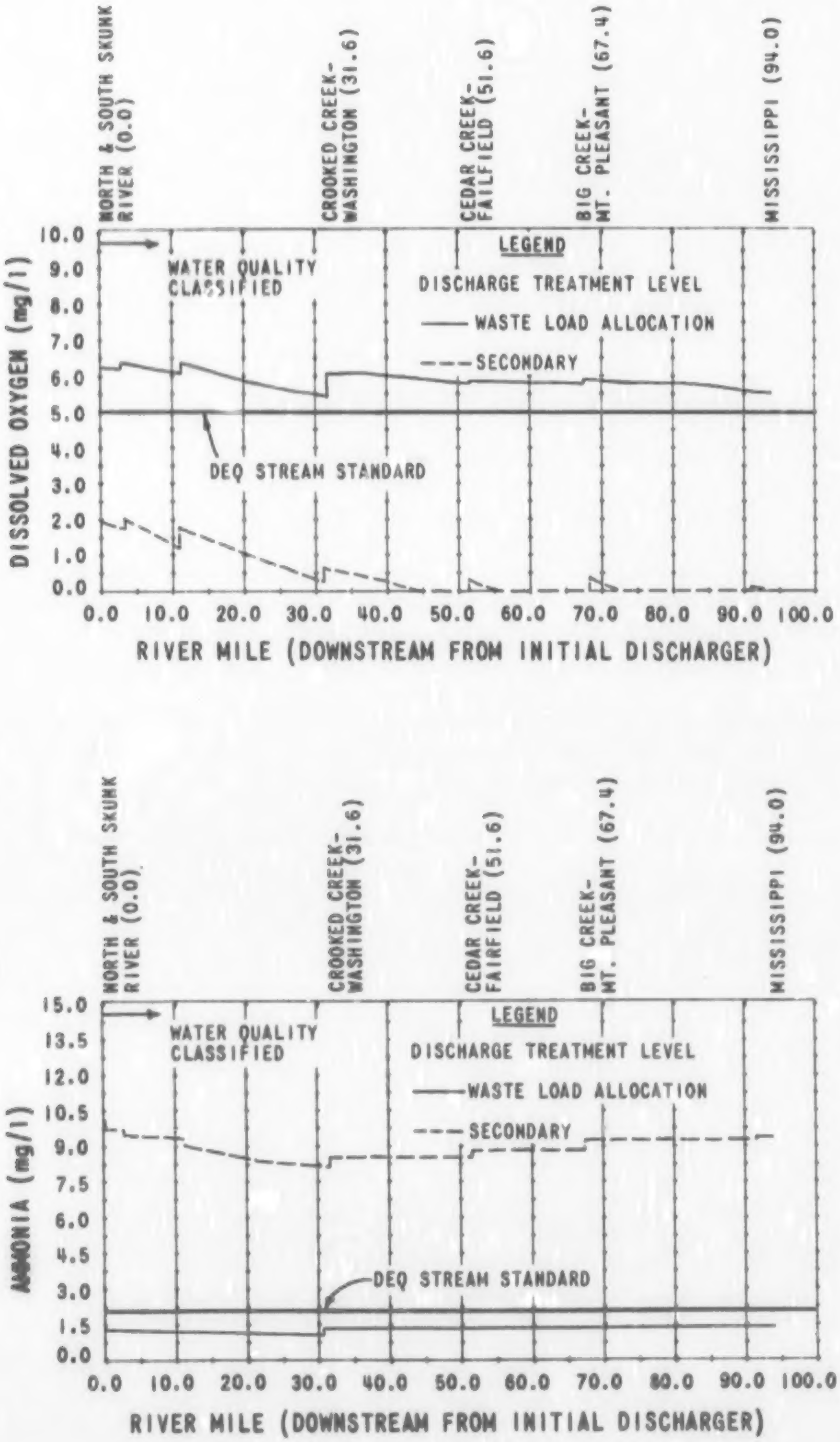


FIGURE VI-6
DISSOLVED OXYGEN AND AMMONIA NITROGEN CONCENTRATION PROFILES, WINTER CONDITIONS
SKUNK RIVER



during low flow conditions must provide a level of wastewater treatment exceeding that of secondary treatment.

Summary

Examination of Table VI-1 shows that restrictions on allowable discharges of BOD_5 and ammonia nitrogen are more stringent under winter low flow conditions than summer. Factors which contribute to this condition are the winter ice cover which reduces reaeration of the stream and the absence of infiltration into the stream in most parts of the basin. Removal of ammonia nitrogen is particularly critical under winter low flow conditions because the pollutant is not being removed by biological oxidation at the low temperatures. Increased treatment levels above those required to meet secondary treatment are necessary for most municipalities during winter low flow conditions. During summer low flow conditions, most dischargers in the upstream portion of the basin will require treatment in addition to secondary treatment, while most dischargers in the downstream portion of the basin can meet water quality standards when providing secondary treatment.

SEGMENT CLASSIFICATION

From the waste load allocation analyses a classification of stream segments is possible. Segment classification is a contributing factor in the determination of the segment ranking, discharger ranking, and compliance scheduling. The two segment types are described as follows:

1. An effluent limited (EL) segment is any segment whose water quality is meeting and will continue to meet standards, or where there is adequate demonstration that standards will be met after application of secondary treatment or BPT to all point discharges to the segment.
2. A water quality limited (WQ) segment is the segment whose water quality does not currently meet applicable standards, and is not expected to meet standards even after application of secondary treatment or BPT to all point discharges to the segment.

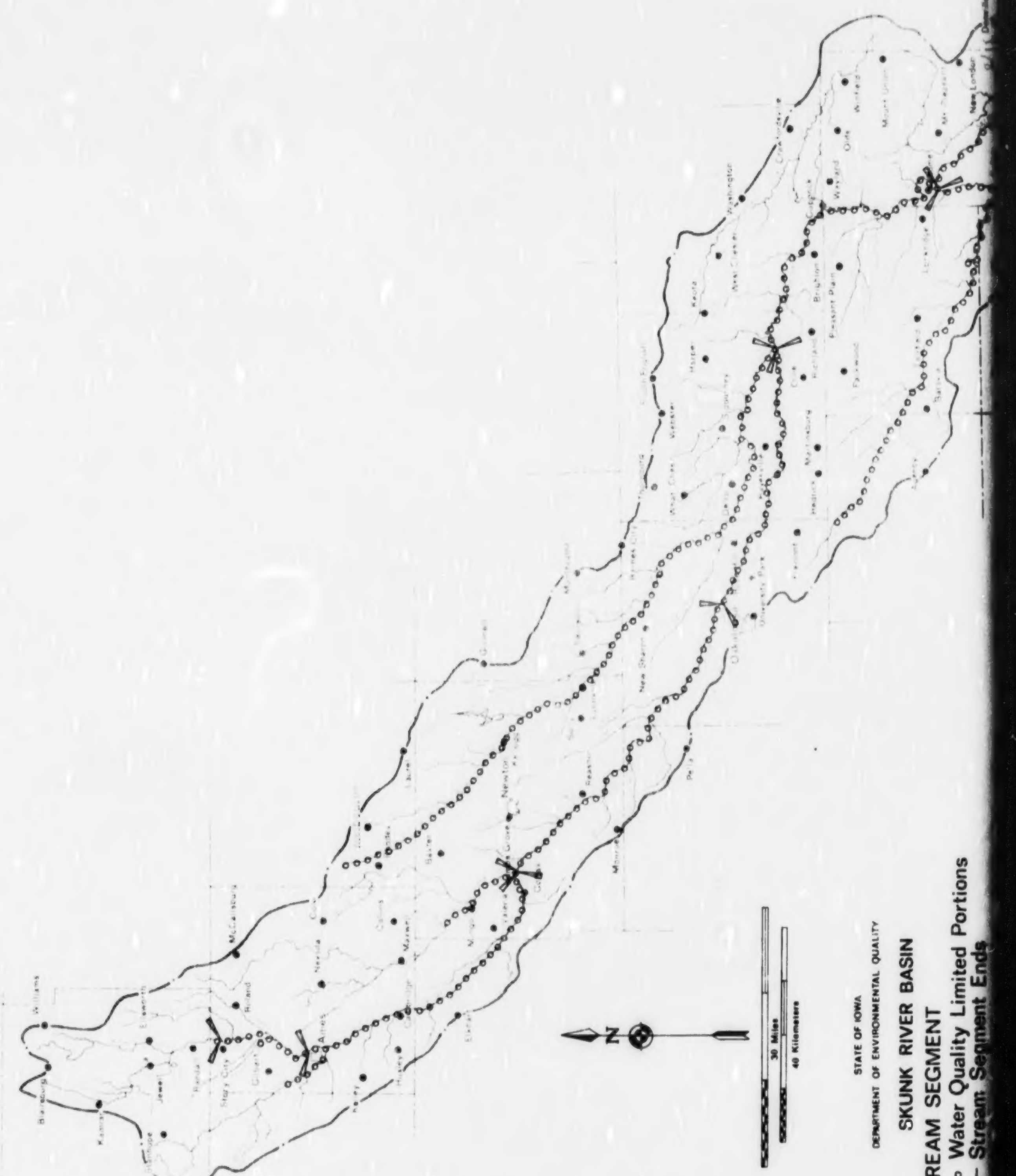
The classification of the stream segments in the Skunk River Basin are listed in Table VI-2. The water quality limited segments are shown in Figure VI-7. All segments which are not designated as water quality limited are currently considered to be effluent limited.

TABLE VI-2

STREAM SEGMENT RANKING

				PRIORITY CRITERIA									
RANK	RIVER	STREAM SEGMENT	WQ/ EL*	A	B_c	B_w	C	BC	AES	POP	SQ	TOTAL POINTS	PRIORITY POINTS
1	South Skunk River	Indian Cr. to Oskaloosa	WQ	0	0	1	2	1	0	2.0	6.0	39.00	11
2	North Skunk River	(entire length)	WQ	0	0	1	0	1	1	2.0	6.0	33.00	10
3	Lower Skunk River	Cedar Creek to Mississippi	WQ	2	0	1	0	1	0	2.0	5.0	32.50	9
4	Mississippi River	Ft. Madison Area	EL	2	0	1	2	1	1	2.0	2.5	23.75	8
5	South Skunk River	Ames to Indian Creek	WQ	0	0	1	0	1	0	2.0	5.0	22.50	7
6	Cedar Creek	(entire length)	WQ	0	0	1	0	1	0	2.0	5.0	22.50	6
7	South Skunk River	Oskaloosa to N. & S. Fork Confluence	WQ	0	0	1	0	1	0	1.5	5.0	20.00	5
8	South Skunk River	Story City to Ames	WQ	0	0	1	0	1	0	2.0	4.0	18.00	4
9	Lower Skunk River	N. & S. Fork Confluence to Cedar Creek	WQ	0	0	1	0	1	0	1.5	4.0	16.00	3
10	Indian Creek	(entire length)	WQ	0	0	1	0	0	0	2.0	4.0	14.00	2
11	South Skunk River	Above Story City	EL	0	0	0	0	1	0	1.0	2.5	6.25	1

* Water Quality or Effluent Limited


Williams
Blairsburg
Kamrar
Stanhope
Jewell
Ellsworth
Randall
Story City
Roland
McCallsburg
Gilbert
Ames
Nevada
Colo
Huxley
Cambridge
Maxwell
Kelley
Elkhart
Collins
Baxter
Mingo
Colfax
Newton
Kellogg
Grinnell
Montezuma
Reasnor
Monroe
Pella
New Sharon
Oskaloosa
University Park
Fremont
Hedrick
Martinsburg
What Cheer
Webster
Keota
Harper
Sigourney
Ollie
Richland
Brighton
Pleasant Plain
Fairfield
Batavia
Libertyville
Washington
West Chester
Crawfordsville
Wayland
Olds
Winfield
Mount Union
Mt. Pleasant
New London
N
30 Miles
40 Kilometers

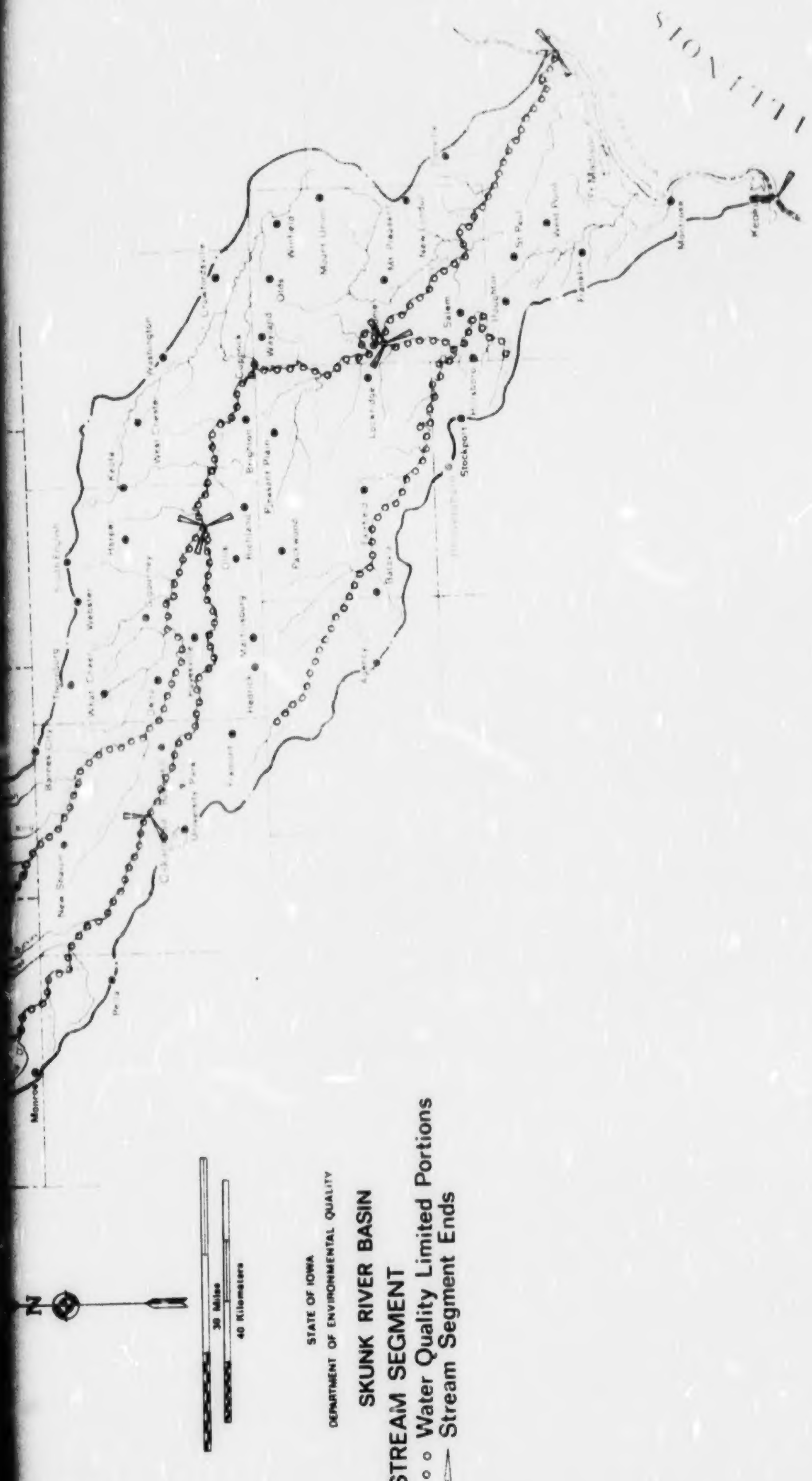
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SKUNK RIVER BASIN

STREAM SEGMENT

○ ○ Water Quality Limited Portions
Stream Segment Ends

A


ILLINOIS
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SKUNK RIVER BASIN
STREAM SEGMENT
○ ○ Water Quality Limited Portions
Stream Segment Ends
30 Miles
40 Kilometers
N
Mount Union
Winfield
Mt Pleasant
New London
Salem
Washington
Keota
Richland
Packwood
Fairfield
Stockport
Keokuk
Montrose
Fort Madison
West Point
St Paul
Farmington
Brighton
Pleasant Plain
Wayland
Olds
Coppock
Lockridge
Batavia
Agency
Hedrick
Martinsburg
Sigourney
Webster
Harper
What Cheer
Delta
Fremont
University Park
Oskaloosa
New Sharon
Barnes City
Pella
Monroe

B

FIGURE VI-7

PRIORITY RANKINGS

Stream Segment Ranking

The Skunk River Basin has been divided into various stream segments. Each stream segment consists of surface waters that have common hydrologic characteristics and natural, physical, chemical, and biological processes. The segments have been ranked in order of abatement priority. The ranking methodology has attempted to take into account: (1) severity of pollution problems, (2) population affected, (3) need for preservation of high quality waters, and (4) national priorities.

The total points for a segment are determined from a product of the points earned in each of two factors. The formula weighs both the degree of usefulness of a segment and the severity of the pollution problem. The specific details and rationale used for the segment ranking methodology have been described in Chapter I.

Table VI-2 lists the stream segments selected, their respective priority points, and their final ranking. Figure VI-7 shows the stream segments.

Table VI-3 lists the reductions in waste load that can be achieved by the waste load allocations.

Municipal Discharger Ranking Methodology

The significant municipal dischargers in the basin have been ranked to be consistent with the segment priority ranking and

TABLE V1-3

WASTE LOAD REDUCTIONS

Discharger	Reference Number	Present		Projected (1990)		Load Reduction
		Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	BOD/NH_3
South Skunk River						
Williams	M- 1	0.053	P.S.	C.D.	C.D.	
Ellsworth	M- 2	0.209	P.S.	C.D.	C.D.	
Drainage Ditch						
Blairsburg	M- 3	0.033	P.S.	C.D.	C.D.	
Kamrar	M- 4	NEMTF	----	C.D.	C.D.	
Jewell	M- 5	0.081	P.S.	C.D.	C.D.	
South Skunk						
Randall	M- 6	NEMTF	----	C.D.	C.D.	
Segment Total			----		----	----
South Skunk River						
Story City	M- 7	0.312	91/24	0.453	26/8	65/16
Roland	M- 8	0.036	P.S.	C.D.	C.D.	
Gilbert	M- 9	0.052	P.S.	C.D.	C.D.	
Stanhope	M-10	0.041	P.S.	C.D.	C.D.	
Segment Total			91/24		26/8	65/16
Ames	M-11	4.85	1942/688	9.353	546/156	1396/532
Kelley	M-12	NEMTF	----	C.D.	C.D.	
Ballard Creek						
Huxley	M-13	0.112	36/23	0.163	10/3	26/20
South Skunk						
Cambridge	M-14	0.061	P.S.	C.D.	C.D.	
Elkhart	M-15	0.013	P.S.	C.D.	C.D.	
Valerie	M-16	NEMTF	----	----	----	
Colfax	M-17	0.12	27/21	0.300	18/5	9/14
Segment Total			2005/732		574/164	1431/566

TABLE VI-3 CONTINUED

Discharger	Reference Number	Present		Projected (1990)		Load Reduction
		Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	BOD/NH_3
Indian Creek						
West Branch Indian Creek						
Nevada	M-18	0.435	91/51	0.800	47/13	44/38
East Branch Indian Creek						
Drainage Ditch #36						
McCallsburg	M-19	----	P.S.	C.D.	C.D.	
East Branch Indian Creek						
Colo	M-20	0.040	P.S.	C.D.	C.D.	
Indian Creek						
Maxwell	M-21	0.066	22/11	0.096	6/2	16/9
Wolf Creek						
Collins	M-22	0.024	P.S.	C.D.	C.D.	
Indian Creek						
Mingo	M-23	0.025	P.S.	C.D.	C.D.	
Clear Creek						
Rhodes	M-24	0.035	----	C.D.	C.D.	
Fullington Creek						
Baxter	M-25	0.068	P.S.	C.D.	C.D.	
Segment Total			113/62		53/15	60/47
Benjamin Creek						
Maytag Dairy Farms	I- 8	.0044	187/1	.004	.4/.5	18.3/.5
Cherry Creek						
Newton N.W.	M-26	0.173	55/29	0.216	13/4	42/25

TABLE VI-3 CONTINUED

		Present		Projected (1990)		Load Reduction
Drainage	Reference Number	Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	BOD/NH_3
Cherry Creek (con't.)						
Lambs Grove	M-27	0.010	3/2	0.012	.7/.2	2.3/1.8
Newton S.W.	M-28	0.263	77/55	0.191	11/3	66/52
Newton W#1	M-29	0.014	3/1	C.D.	C.D.	3/1
Newton W#2	M-30	0.040	12/5	C.D.	C.D.	12/5
Sewer Creek						
Newton S.	M-31	2.17	452/181	2.325	136/39	316/142
South Skunk						
Reasnor	M-32	0.10	P.S.	C.D.	C.D.	
Buck Creek						
Monroe E.	M-33	0.087	39/18	0.105	6/2	33/16
Thunder Creek						
Pella N.W.	M-34	0.15	33/25	0.150	9/3	24/22
Pella N.E.	M-35	1.058	362/221	1.746	102/29	260/192
Segment Total			1054.7/538		278.1/80.7	776.6/457.3
Spring Creek						
University Park	M-36	0.054	14/5	0.055	3/1	11/4
Oskaloosa N.E.	M-37	0.980	327/41	1.185	66/20	261/21
South Skunk						
Rose Hill	M-38	NEMTF	----	----	----	
Sugar Creek						
Hedrick	M-39	0.035	P.S.	C.D.	C.D.	
South Skunk						
Martinsdale	M-40	NEMTF	----	----	----	
Ollie	M-41	NEMTF	----	C.D.	C.D.	
Segment Total			341/46		69/21	272/25

TABLE VI-3 CONTINUED

		Present		Projected (1990)		Load Reduction
Discharger	Reference Number	Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	BOD/NH_3
North Skunk						
Snipe Creek						
Melbourne	M-42	0.048	18/10	0.063	16/1	2/9
Alloway Creek						
Laurel	M-43	NEMTF	----	C.D.	C.D.	
North Skunk						
Smith & Jones Inc.	I-15	0.071	28/6	NA	8/3	20/3
Kellogg	M-44	0.023	11/6	0.06	25/2	[1]--/4
Slater Creek						
Sully	M-45	0.084	P.S.	C.D.	C.D.	
Lynnville	M-46	0.010	P.S.	C.D.	C.D.	
Sugar Creek						
Grinnell	M-47	1.838	383/153	2.527	148/42	235/111
West Creek						
Searsboro	M-48	NEMTF	----	C.D.	C.D.	
Moon Creek						
Montezuma	M-49	0.097	P.S.	C.D.	C.D.	
Pleasant Creek						
Barnes City	M-50	NEMTF	----	C.D.	C.D.	
Middle Creek						
New Sharon	M-51	0.069	20/12	0.117	29/2	[1]--/10
North Skunk						
Hayesville	M-52	NEMTF	----	----	----	

TABLE VI-3 CONTINUED

Discharger	Reference Numver	Present		Projected (1990)		Load Reduction
		Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	BOD/NH_3
Cedar Creek						
Cool Creek						
What Cheer	M-53	0.069	20/12	0.080	20/1	0/11
Cedar Creek						
Delta	M-54	NEMTF	----	C.D.	C.D.	
Rock Creek						
Thornburg	M-55	NEMTF	----	----	----	
Sigourney W.	M-56	0.095	20/8	0.105	26/2	--/6
Bridge Creek						
Sigourney E.	M-57	0.100	31/17	0.100	25/2	6/15
German Creek						
Webster	M-58	NEMTF	----	----	----	
South English	M-59	NEMTF	----	C.D.	C.D.	
Segment Total			531/224		297/55	263/169
Skunk River						
Clear Creek						
Harper	M-60	NEMTF	----	C.D.	C.D.	
Dutch Creek						
Keota	M-61	0.105	38/22	0.124	31/16	7/6
Skunk River						
Richland	M-62	NEMTF	----	C.D.	C.D.	
Brighton	M-63	0.043	14/7	0.048	12/6	2/1
Crooked Creek						
West Fork Crooked Creek						
West Chester	M-64	NEMTF	----	C.D.	C.D.	
Washington	M-65	1.058	291/176	1.360	147/34	144/142

TABLE VI-3 CONTINUED

Discharger	Reference Number	Present		Projected (1990)		Load Reduction
		Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	BOD/NH_3
East Fork Crooked Creek						
Mt. Union	M-66	NEMTF	----	C.D.	C.D.	
Winfield	M-67	0.045	10/9	0.100	11/3	--[1]/6
Olds	M-68	NEMTF	----	C.D.	C.D.	
Crawfordsville	M-69	NEMTF	----	C.D.	C.D.	
Crooked Creek						
Coppock	M-70	NEMTF	----	----	----	
Sugar Creek						
Wayland	M-71	0.021	P.S.	C.D.	C.D.	
Walnut Creek						
Burr Oak Creek						
Pleasant Plain	M-72	NEMTF	----	----	----	
Brush Creek						
Lockridge	M-73	NEMTF	----	----	----	
Skunk River						
Rome	M-74	NEMTF	----	----	----	
Segment Total			353/214		201/59	153/155
Cedar Creek						
Fremont	M-75	0.048	P.S.	C.D.	C.D.	
Buckeye Creek						
Agency	M-76	0.061	P.S.	C.D.	C.D.	
Competine Creek						
Coon Creek						
Packwood	M-77	0.016	P.S.	C.D.	C.D.	

TABLE VI-3 CONTINUED

		Present		Projected (1990)		Load
Discharger	Reference Number	Flow (mgd)	lbs.Eff. BOD_5/NH_3	Flow (mgd)	lbs.Eff. BOD_5/NH_3	Reduction BOD/NH_3
Rock Creek						
Batavia	M-78	NEMTF	----	C.D.	C.D.	
Mitchell Creek						
North American Rockwell Corp.	I-29	0.080	(53/3)*	NA	(53/3)*	
			*COD/Oil & Grease Values			
Cedar Creek						
Crow Creek						
Fairfield	M-79	0.729	164/61	1.600	93/27	71/34
Cedar Creek						
Birmingham	M-96	.014	P.S.	C.D.	C.D.	
Stockport	M-80	NEMTF	----	C.D.	C.D.	
Hillsboro	M-81	NEMTF	----	C.D.	C.D.	
Segment Total			164/61		93/27	71/34
Fish Creek						
Salem	M-82	0.035	P.S.	C.D.	C.D.	
Big Creek						
Mt. Pleasant	M-83	0.988	206/82	1.107	120/18	86/64
New London	M-84	0.254	55/21	0.323	35/5	20/16
Long Creek						
Danville	M-85	0.103	P.S.	C.D.	C.D.	
Brush Creek						
Middletown	M-86	.043	21/9	.069	17/9	4/0
IA Ammunition Plant	I-36	0.800	----	0.800	87/13	
Segment Total			282/112		259/45	110/80

TABLE VI-3 CONTINUED

Discharger	Reference Number	Present Flow (mgd)	Present lbs.Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD/NH_3
Mississippi River						
Fort Madison	M-87	3.516	3900/880	5.76	1441/722	2459/158
Armour-Dial	I-38	2.00	700/313	2.0	363/313	337/0
Consolidated Packaging Co.	I-39	0.685	12300/--	.685	1570/ --	10730/--
Taylor Slough						
Fort Madison W.	M-88	0.028	7/4	0.25	63/31	1/
Mississippi River						
Chevron Chemical Co.	I-44	54.0	1950*/960	NA	--/98	--/862
Sugar Creek						
West Branch Little Sugar Creek						
Houghton	M-89	0.018	P.S.	C.D.	C.D.	
Franklin	M-90	NEMTF	----	----	----	
Devils Creek						
West Point	M-91	0.070	15/6	.146	18/9	1/
Mississippi River						
Montrose	M-92	0.04	8/3	.103	25/12	1/
Keokuk (Hazelhurst)	M-93	0.017	3.5/1.4	.012	4/2	1/
Soap Creek						
Sheller Globe Corp.	I-50	0.030	22.3*/-- *COD values	NA	2.5*/--	--/--
Mississippi River						
Hubinger Co.	I-51	5.125	6411/--	NA	1300/--	5111/--
Keokuk	M-94	3.2	8006/1334	1.511	788/395	7218/939
Foote Mineral	I-54	0.50	--/--	NA	42*/-- *Oil & Grease Values	
Segment Total			31,350.5/3501.4		5572/1582	25855/1959

1/ Minor load increase due to increased population growth or New STP being constructed with increased flow.

to be subsequently used in establishing priorities and output estimates for municipal facilities construction. The relative significance of each discharger is determined by its total points as calculated by the discharger ranking formula. The specific details and rationale used for the municipal discharger ranking methodology have been described in Chapter I.

Table VI-4 lists the municipalities in the basin, their priority points, and their final ranking.

Table VI-4

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria						Segment Points	Priority Points
		$\underline{A}_1$	$\underline{A}_2$	$\underline{B}_1$	$\underline{B}_2$	$\underline{D}_1$	$\underline{D}_2$		
1	Keokuk	60	60	.90	.70	25	25	8	144.47
2	Pella N.E.	40	40	.72	.87	16	16	11	99.87
3	Newton S.W.	30	40	.86	.95	12	14	11	98.05
4	Monroe E.	50	40	.85	.75	9	7	11	96.17
5	Ames	40	30	.72	.77	21	18	4	84.97
6	Newton N.W	30	30	.76	.86	12	12	11	79.28
7	Huxley	30	40	.72	.87	9	9	7	77.78
8	Fort Madison	60	40	.63	.18	25	21	8	72.55
9	Pella N.W.	20	30	.73	.88	9	9	11	66.41
10	Newton S.	20	20	.70	.78	16	16	11	64.41
11	Washington	30	30	.49	.81	16	16	3	62.88
12	Maxwell	30	30	.73	.82	9	9	2	62.27
13	Grinnell	20	20	.62	.73	16	16	10	58.28
14	Lambs Grove	30	20	.77	.90	1	3	11	55.47
15	University Park	30	20	.79	.80	7	5	5	54.07
16	Story City	30	20	.71	.67	12	9	4	53.33
17	Melbourne	40	40	.11	.90	7	7	5	52.52
18	Sigourney E.	30	30	.19	.88	9	9	10	51.96
19	Mt. Pleasant	20	20	.42	.78	14	14	9	49.73
20	What Cheer	30	30	.09	.92	9	9	10	49.30

Table VI-4

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
21	Colfax	10	30	.33	.76	9	9	7	46.38
22	Nevada	20	20	.48	.75	12	14	2	42.81
23	New London	20	20	.36	.76	12	9	9	42.73
24	New Sharon	30	30	.00	.83	7	9	10	42.50
25	Kellogg	50	40	.00	.67	7	7	10	41.33
26	Fairfield	20	20	.43	.56	14	14	6	39.67
27	Sigourney W.	20	20	.00	.75	7	7	10	30.25
28	Oskaloosa N.E.	00	10	.79	.51	16	12	5	28.89
29	Keota	40	40	.18	.27	9	9	3	25.39
30	Winfield	20	20	.00	.67	5	7	3	21.00
31	Middleton	50	40	.19	.00	9	7	9	20.24
32	Stanhope	40	30	.14	.14	7	7	4	16.00
33	Newton E.	30	20	.08	.00	7	5	11	14.08
34	Fremont	20	20	.08	.25	7	7	3	11.83
35	Reasnor	30	30	.00	.00	5	5	11	11.00
36	Newton W.	20	10	.00	.00	1	1	11	11.00
37	Montezuma	20	20	.00	.00	7	9	10	10.00
38	Sully	30	20	.00	.00	7	7	10	10.00
39	Lynnville	50	40	.00	.00	3	3	10	10.00
40	Delta	00	00	.00	.00	0	0	10	10.00

Table VI-4

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria A1	A2	B1	B2	D1	D2	Segment Points	Priority Points
41	Barnes City	00	00	.00	.00	0	0	10	10.00
42	South English	00	00	.00	.00	0	0	10	10.00
43	Danville	20	20	.00	.00	9	9	9	9.00
44	Salem	40	40	.00	.00	7	7	9	9.00
45	Brighton	30	30	.00	.14	7	7	3	8.29
46	Fort Madison W.	20	20	.00	.00	5	5	8	8.00
47	West Point	20	20	.00	.00	7	7	8	8.00
48	Montrose	20	20	.00	.00	5	5	8	8.00
49	Houghton	20	20	.00	.00	3	3	8	8.00
50	Keokuk Hazelhurst	20	20	.00	.00	3	1	8	8.00
51	Cambridge	30	01	.00	.00	7	0	7	7.00
52	Elkhart	30	30	.00	.00	3	3	7	7.00
53	Kellogg	00	00	.00	.00	0	0	7	7.00
54	Stockport	00	00	.00	.00	0	0	6	6.00
55	Hillsboro	00	00	.00	.00	0	0	6	6.00
56	Hedrick	20	20	.00	.00	5	5	5	5.00
57	Laurel	00	00	.00	.00	0	0	5	5.00
58	Ollie	00	00	.00	.00	0	0	5	5.00
59	Jewell	30	30	.00	.00	9	9	4	4.00
60	Roland	20	20	.00	.00	5	5	4	4.00

Table VI-4

MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria $\underline{A}_1$	$\underline{A}_2$	$\underline{B}_1$	$\underline{B}_2$	$\underline{D}_1$	$\underline{D}_2$	Segment Points	Priority Points
61	Gilbert	30	10	.00	.00	7	5	4	4.00
62	Williams	30	30	.00	.00	7	7	4	4.00
63	Ellsworth	20	20	.00	.00	9	9	4	4.00
64	Blairsburg	20	20	.00	.00	5	5	4	4.00
65	Kamrar	00	00	.00	.00	0	0	4	4.00
66	Wayland	20	20	.00	.00	3	5	3	3.00
67	Agency	20	20	.00	.00	7	7	3	3.00
68	Packwood	20	20	.00	.00	1	3	3	3.00
69	Richland	00	00	.00	.00	0	0	3	3.00
70	Batavia	00	00	.00	.00	0	0	3	3.00
71	Harper	00	00	.00	.00	0	0	3	3.00
72	Crawfordsville	00	00	.00	.00	0	0	3	3.00
73	Lockridge	00	00	.00	.00	0	0	3	3.00
74	Olds	00	00	00	.00	0	0	3	3.00
75	West Chester	00	00	.00	.00	0	0	3	3.00
76	Mount Union	00	00	.00	.00	0	0	3	3.00
77	Baxter	30	30	.00	.00	7	9	2	2.00
78	Colo	50	40	.00	.00	7	7	2	2.00
79	Collins	20	20	.00	.00	5	5	2	2.00
80	Rhodes	10	20	.00	.00	5	5	2	2.00
81	McCallsburg	20	20	.00	.00	5	5	2	2.00
82	Mingo	30	30	.00	.00	5	5	2	2.00

REFERENCES

1. Supporting Document For Iowa Water Quality Management Plans, Iowa Department of Environmental Quality, Water Quality Management Division, Des Moines, Iowa 1976.

CHAPTER VII - NONPOINT POLLUTION SOURCES

Flow contributions into surface waters from sources other than readily identifiable domestic, industrial, commercial, and institutional point discharges may have a substantial impact on water quality. The water resource may be adversely effected by nonpoint discharges associated with combined sewer overflows, urban and rural runoff, and agricultural waste.

GENERAL RURAL RUNOFF

Approximately 95 percent of the Skunk River Basin is classified as agricultural land. The pollution potential of general rural runoff has been developed and related to specific conditions in the study area.

An estimation of the land use in each drainage area was developed using the 1970 *Iowa Conservation Needs Inventory* (4). Land use acreages are listed in Table VII-1.

TABLE VII-1

LAND USE CLASSIFICATIONS

Hydrologic Unit	Land Use in Acres					
	Cropland	Pasture	Forest	Urban	Other	Total
North Skunk	405,678	83,956	39,236	20,893	15,078	564,841
South Skunk	878,572	120,532	65,107	63,647	37,056	1,164,914
Lower Skunk	684,127	137,226	143,421	48,568	31,895	1,047,237
Sub-Total	1,968,377	341,714	247,764	133,198	85,029	2,774,992
Other	99,107	23,439	38,246	75,111	5,504	241,407
Total	2,067,484	365,153	286,010	208,219	90,533	3,016,399

A detailed analysis was conducted to estimate nutrient losses within the study area. Nutrient loads in the basin were estimated based on sampling conducted in the Des Moines River since insufficient data were available to conduct a nutrient runoff analysis on the Skunk River. Annual nitrogen and phosphorus losses were assumed to be 10.87 and 1.35 lbs/acre respectively. The estimated nutrient loading for each hydrologic unit in the Skunk River Basin was then estimated based on these average annual losses per acre calculated for the Des Moines River above Saylorville Dam (Table VII-2).

TABLE VII-2

ESTIMATED NUTRIENT LOADINGS FROM NONPOINT SOURCES

Hydrologic Unit	Nitrogen Lbs/Yr	Phosphorus Lbs/Yr
North Skunk	6,139,820	762,535
South Skunk	12,662,615	1,572,635
Lower Skunk	11,361,725	1,411,070
Other	2,624,095	325,900
Total	32,788,255	4,072,140

The 1970 Conservation Needs Inventory (4) was used to summarize treatment measures necessary to reduce surface runoff and limit soil losses to levels established by the Soil Conservation Districts (Table VII-3). The associated implementation costs

TABLE VII-3

RUNOFF CONTROL MEASURES REQUIRED

SKUNK RIVER BASIN

Hydrologic Unit	Cropland Acres		Pasture Acres				Acres
	Terracing Stripcropping	Grade Stabilization	Diversions	Land Conversions	Critical Area Planting	Grassland Management	Woodland Management
North Skunk	144,441	6,158	2,894	0	12,607	771	23,911
South Skunk	218,813	92,492	15,283	1,922	11,901	7,116	36,229
Lower Skunk	208,311	52,630	6,584	465	46,075	10,646	94,940
Sub-Total	571,565	151,280	24,761	2,387	70,583	18,533	155,080
Other	26,467	21,913	1,939	62	6,165	2,970	21,997
Total	598,032	173,193	26,700	2,449	76,748	21,503	177,077

were then developed based on these needs and cost estimates provided by the Soil Conservation Service (Table VII-4). The cost of treatment measures to reduce runoff from cropland was by far the largest cost segment as expected since cropland would be more susceptible to runoff due to limited soil cover. Annual costs developed by Stanley Consultants for the various types treatment are also listed in Table VII-4. Total capital costs are shown in Table VII-5. The total capital cost of the runoff control measures for the Skunk River Basin is over 141 million dollars.

TABLE VII-4

UNIT COSTS FOR STATEWIDE CONTROLS

Land Use	Total Cost	Total Acres	Capital Cost/Acre	Annual Cost/Acre
Cropland				
Stripcropping and Terracing	$824,677,000	7,932,499	$ 103.96	$5.00
Grade Stabilization	$638,440.000	1,873,037	$ 340.86	$1.50
Pasture				
Diversions	$ 7,003,000	610,660	$ 11.47	$5.00
Land Conversions	$ 29,647,000	16,682	$1,777.18	$2.00
Critical Area Planting	$ 8,003,000	715,003	$ 11.19	$1.00
Grassland Management	$ 9,296,000	229,332	$ 40.54	$1.00
Woodland				
Woodland Management	$160,080,000	2,055,435	$ 77.88	$2.00
	$1,677,145,000	13,432,648		

TABLE VII-5

RUNOFF CONTROL COSTS BY SUBBASIN

SKUNK RIVER BASIN

	Cropland		Pasture					
Hydrologic Unit	Terracing Stripcropping	Grade Stabilization	Diversions	Land Conversions	Critical Area Planting	Grassland Management	Woodland Management	Total
North Skunk	$ 15,016,348	$ 2,099,005	$ 33,188	$ 0	$ 141,092	$ 31,253	$ 1,862,220	$ 19,183,106
South Skunk	$ 22,748,196	$ 31,526,655	$ 175,264	$3,415,749	$ 133,191	$ 288,448	$ 2,821,562	$ 61,110,065
Lower Skunk	$ 21,656,389	$ 17,939,366	$ 75,505	$ 826,391	$ 515,651	$ 431,537	$ 7,394,953	$ 48,838,892
Sub Total	$ 59,420,933	$ 51,565,026	$ 283,957	$4,242,140	$ 789,934	$ 751,238	$12,077,835	$129,131,063
Other	$ 2,751,557	$ 7,469,225	$ 22,236	$ 110,185	$ 68,996	$ 120,389	$ 1,713,155	$ 12,255,743
Total	$ 62,172,490	$ 59,034,251	$ 306,193	$4,352,325	$ 858,930	$ 871,627	$13,790,990	$141,386,806

ANIMAL FEEDING OPERATIONS

In order to determine the size and location of livestock facilities in the study area, information was gathered on feeding operations registered with the Department of Environmental Quality. Livestock census information was obtained from the Iowa Annual Farm Census, 1971 (3) to establish the number and distribution of animals in the study area (Table VII-6). The inventory information developed is representative of conditions at a particular point in time. A completely accurate account of livestock feeding operation capacity is not practical or even possible. The number of livestock on feed and even the number of feeding operations is subject to many variables, the most significant of which is livestock marketing conditions.

TABLE VII-6

LIVESTOCK DISTRIBUTION BY SUBBASIN

SKUNK RIVER BASIN

Hydrologic Unit	Hogs	Cattle	Sheep	Poultry
North Skunk	379,548	46,201	9,187	274,833
South Skunk	591,601	100,246	29,500	743,755
Lower Skunk	558,473	42,614	23,728	709,506
Sub-Total	1,529,622	189,061	62,415	1,728,094
Other	78,708	11,195	2,279	29,607
Total	1,608,330	200,256	64,694	1,757,701

The inventory data accumulated for the basin, however, does highlight livestock feeding as a significant potential source of water pollution. The locations of registered animal feeding operations are shown on Figure VII-1. The animal numbers of each operation may be identified through the appropriate reference number in Table VII-7.

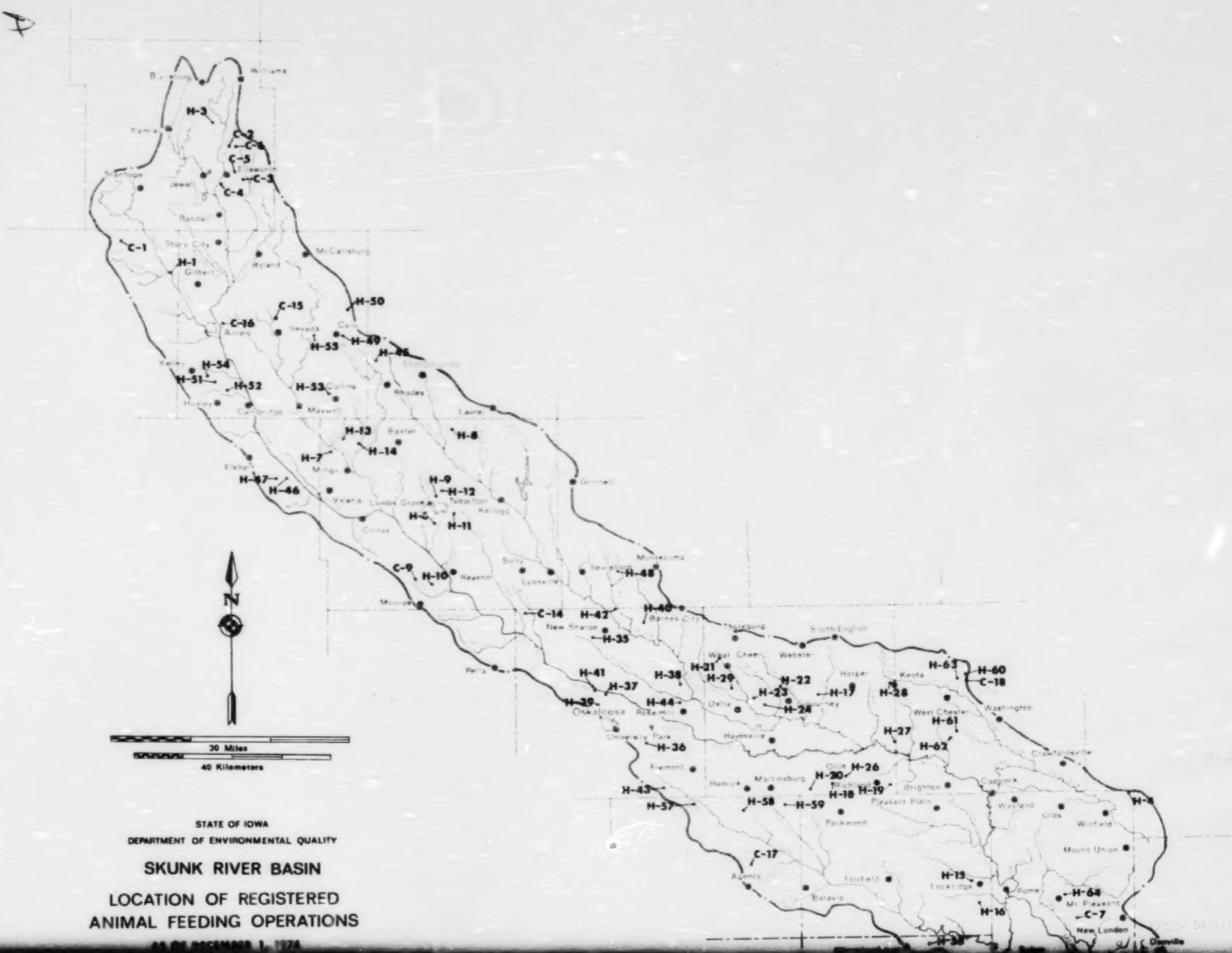
Cattle densities in the Skunk River range from a low of 0.04 head per acre in the Lower Skunk Subbasin to a high of 0.08 in the South Skunk River drainage area. Swine densities vary between 0.50 head per acre in the South Skunk River drainage area to 0.67 in the North Skunk River drainage area.

Because of insufficient data, quantitative estimates of potential pollution loads from feeding operations were not calculated. As indicated in Table VII-7, there are 17 registered feeding operations with a cumulative capacity for 7,695 cattle. The remaining 192,561 cattle in the study area are dispersed throughout the basin. Similar dispersion of the swine, sheep and poultry populations occurs in the basin. Because of the areal distribution of animals, somewhat misleading conclusions could result from a projection of total pollution potential for each watershed.

Animal Feeding Operation Pollution Abatement Costs

In order to indicate the relative magnitude of treatment costs for feeding operations in the basin, capital cost estimates have been developed for treatment systems for both cattle and

A

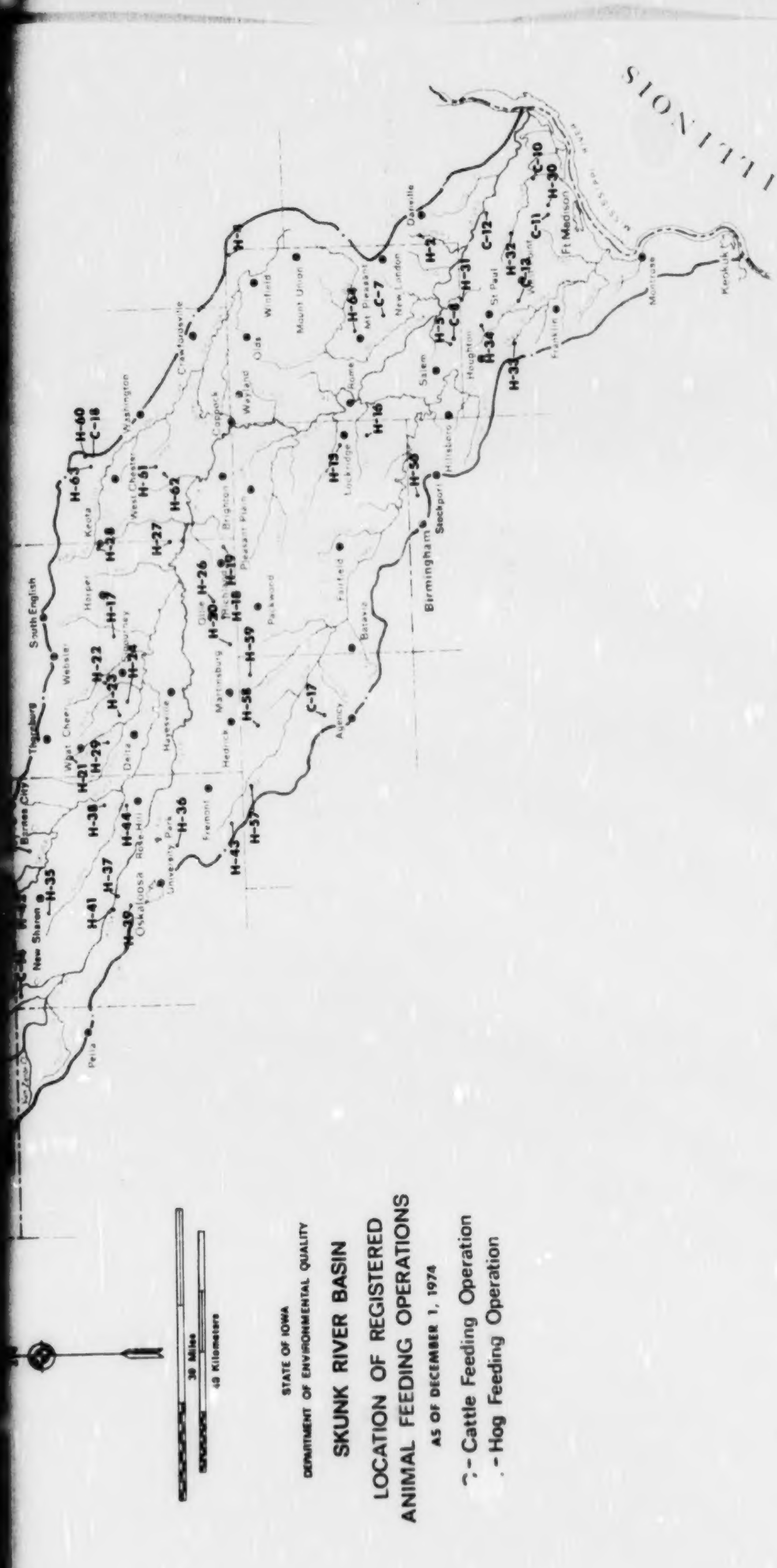

Blairsburg
Williams
H-3
Kamrar
C-2
C-6
C-5
Ellsworth
C-3
Stanhope
Jewell
C-4
Randall
Story City
C-1
H-1
Gilbert
Roland
McCallsburg
C-15
H-50
C-16
Ames
Nevada
Colo
H-55
H-49
H-45
Kelley
H-54
H-51
H-52
Huxley
Cambridge
H-53
Collins
Maxwell
Rhodes
Laurel
H-13
Baxter
H-8
H-14
H-7
Mingo
Elkhart
H-47
H-46
Valeria
Lambs Grove
H-9
H-12
Newton
Kellogg
H-5
H-11
Colfax
Grinnell
Sully
Lynnville
Searsboro
Montezuma
H-48
C-9
H-10
Reasnor
Monroe
C-14
H-42
H-40
Barnes City
New Sharon
H-35
Thornburg
South English
West Chester
Webster
H-21
H-29
H-22
Harper
Keota
H-63
H-60
C-18
H-23
H-17
H-28
H-24
Sigourney
Delta
Pella
H-41
H-37
H-38
H-39
Oskaloosa
H-44
Rose Hill
Hayesville
University Park
H-36
West Chester
Washington
H-61
H-27
H-62
Crawfordsville
Fremont
Ollie
H-26
Hedrick
Martinsburg
H-20
Richland
H-18
H-19
Brighton
Coppock
H-43
H-57
H-58
H-59
Pleasant Plain
Packwood
Wayland
Olds
Winfield
H-4
Mount Union
C-17
Agency
Fairfield
Batavia
H-15
Lockridge
Rome
H-64
Mt Pleasant
H-16
C-7
New London
H-30
Danville
N
30 Miles
40 Kilometers

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY

SKUNK RIVER BASIN

LOCATION OF REGISTERED ANIMAL FEEDING OPERATIONS

AS OF DECEMBER 1, 1974


STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SKUNK RIVER BASIN
LOCATION OF REGISTERED
ANIMAL FEEDING OPERATIONS
AS OF DECEMBER 1, 1974
C - Cattle Feeding Operation
H - Hog Feeding Operation
30 Miles
48 Kilometers
ILLINOIS
Mississippi River
Pella
New Sharon
Oskaloosa
University Park
Rose Hill
Barnes City
Thornburg
What Cheer
Delta
Hayesville
Webster
South English
Harper
Keota
Sigourney
West Chester
Washington
Crawfordsville
Fremont
Hedrick
Martinsburg
Ollie
Richland
Packwood
Pleasant Plain
Brighton
Coppock
Wayland
Olds
Winfield
Mount Union
Agency
Batavia
Fairfield
Lockridge
Birmingham
Stockport
Hillsboro
Salem
Rome
Mt Pleasant
New London
Danville
Houghton
St Paul
Ft Madison
Franklin
Montrose
Keokuk
H-1
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H-60
H-62
H-63
H-64
C-7
C-8
C-10
C-11
C-12
C-13
C-17
C-18

FIGURE VII-1

TABLE VII-7

ANIMAL FEEDING OPERATIONS; SKUNK RIVER BASIN

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
		CATTLE FEEDING OPERATIONS		
2-08-00-0-04	Boone	150	C- 1	RC
2-40-00-0-01	Hamilton	850	c- 2	RC
" 04		700	C- 3	ST
" 05		700	C- 4	ST
" 08		500	C- 5	ST
" 09		500	C- 6	ST
2-44-00-0-01	Henry	400	C- 7	RC
" 02		350	C- 8	ST
2-50-00-0-05	Jasper	600	C- 9	ST
2-51-00-0-01	Lee	150	C-10	RC
" 02		300	C-11	RC
2-56-00-0-04		80	C-12	RC
" 05		200	C-13	RC
2-62-00-0-01	Mahaska	375	C-14	ST
2-85-00-0-01	Story	600	C-15	NC
" 05			C-16	NA
2-90-00-0-02	Wapello	240	C-17	ST
2-92-00-0-03	Washington	1,000	C-18	ST
		HOG FEEDING OPERATIONS		
2-08-00-4-02	Boone	275	H- 1	ST
2-29-00-4-02	Des Moines	40	H-2	ST
2-40-00-4-02	Hamilton	220	H- 3	ST
2-44-00-4-01	Henry	18	H-64	SL
" 02		480	H- 4	ST
" 03		400	H- 5	ST

TABLE VII-7 (CONTINUED)

Registration No.		No. Of Animals	Ref. No.	Type Controls*
2-50-00-4-01	Jasper	200	H- 6	ST
" 02		852	H- 7	SL
" 03		200	H- 8	ST
" 05		15	H- 9	NC
" 06		630	H-10	ST
" 07		800	H-11	SL
" 08		180	H-12	ST
" 10		400	H-13	ST
" 11		420	H-14	ST
2-51-00-4-01	Jefferson	370	H-15	SL
" 02		680	H-16	SL
2-54-00-4-01	Keokuk	400	H-17	ST
" 02		36	H-18	ST
" 03		560	H-19	ST
" 04		540	H-20	ST
" 05		430	H-21	ST
" 06		100	H-22	SL
" 07		400	H-23	SL
" 08		500	H-24	ST
" 09		600	H-25	ST
" 10		360	H-26	ST
" 11		1,200	H-27	ST
" 12		340	H-28	ST
" 13		300	H-29	ST
2-56-00-4-01	Lee	500	H-30	ST
" 03		680	H-31	SL
" 04		280	H-32	ST
" 05		200	H-33	ST
" 06		268	H-34	ST
2-62-00-4-02	Mahaska	450	H-35	ST
" 04		1,200	H-36	ST
" 05		500	H-37	ST
" 07		270	H-38	ST
" 08		220	H-39	ST
" 09		720	H-40	SL
" 10		500	H-41	ST
" 11		400	H-42	ST
" 12		480	H-43	ST
" 15		800	H-44	ST

TABLE VII-7 (CONTINUED)

Registration No.		No. Of Animals	Ref. No.	Type Controls
2-64-00-4-05	Marshall	1,200	H-45	ST
2-77-00-4-01	Polk	480	H-46	ST
" 02		1,000	H-47	ST
2-79-00-4-02	Poweshiek	750	H-48	SL
2-85-00-4-01	Story	1,000	H-49	ST
" 03		200	H-50	ST
" 04		20	H-51	ST
" 05		132	H-52	ST
" 07		250	H-53	ST
" 08		400	H-54	ST
" 09		18	H-55	ST
2-89-00-4-04	Van Buren	300	H-56	ST
2-90-00-4-01	Wapello	420	H-57	ST
" 02		400	H-58	ST
" 03		500	H-59	NC
2-92-00-4-04	Washington	770	H-60	ST
" 04		1,100	H-61	ST
2-92-81-4-05		350	H-62	ST
" 07		160	H-63	RC

SB - Storage Basin
SL - Lagoon
RC - Runoff Controls
ST - Below Building Storage - or Tank
NC - No Control
NA - Not Available

swine operations. Most registered feeding operations in the basin presently have adequate treatment facilities. For purposes of this cost estimate, it is, therefore, necessary to approximate the number of unregistered beef cattle and swine which are in confined feeding operations that require treatment facilities. Testimony given before a U. S. House of Representative subcommittee (1) estimates that 22 percent of the hog operations and 26 percent of the beef cattle feeding operations in the United States have pollution problems requiring remedial measures. Treatment costs presented in Table VII-8 reflect the above percentages of unregistered animals in the basin and treatment costs from the EPA (2).

TABLE VII-8

LIVESTOCK TREATMENT COSTS*

	Initial Capital Costs		
Hydrologic Unit	Cattle	Swine	Total
Skunk River Basin	$734,210	$3,859,833	$4,594,043

* 1974 Dollars

No treatment costs are provided for sheep since no confined sheep feeding operations are identified in the basin. Most poultry in the basin are located in a relatively small number of large egg-laying or turkey raising operations. Waste handling facilities are normally taken into consideration during the design of the operation, and most facilities presently spread the dry waste on agricultural land. For these reasons, no costs have been determined for poultry operations.

URBAN RUNOFF

In urbanized areas, surface runoff and combined sewer overflows can adversely affect the utility of the water resource. Contaminants discharged to a watercourse are the result of debris, animal droppings, eroded soil, tire and vehicular exhaust residues, deicing compounds, pesticides, fertilizers, air pollution fallout, and decayed vegetation contained in the urban runoff. These materials can be discharged into the stream during periods of precipitation or snow melt.

The impact of urban runoff upon the aquatic environment is difficult to quantify based upon present information. In addition to having little data in the basin identifying specific pollution contributions and the resulting impact from urban runoff, available technical literature has not resolved the impact of these sources upon streams.

Corrective measures applicable for urban storm-water runoff pollution abatement may be classified as preventive or curative. Preventive practices may consist of proper conservation techniques on land development projects to reduce sediment erosion. Also, improved collection of material through normal municipal street cleaning operations should reduce the waste load that currently reaches the streams. Curative solutions may require substantial physical facilities and result in large capital expenditures.

Generalized cost curves which were developed for the 1974 Survey of Needs of Municipal Wastewater Treatment Facilities were used to give an indication of the cost to treat and/or control urban storm water runoff in the basin. The curves were based upon a composite of local consulting engineers' estimates for treating urban runoff. The cost estimate developed for the Skunk River Basin, and found in Table VII-9, exceeded 204 million dollars.

TABLE VII-9

URBAN STORMWATER TREATMENT AND/OR CONTROL COSTS

Hydrologic Unit	Cost*
North Skunk	$ 36,950,000
South Skunk	$ 88,605,000
Lower Skunk	$ 78,745,000
Total	$204,300,000

* 1974 Dollars

REFERENCES

1. "Control of Pollution from Animal Feedlots." A hearing before a subcommittee of the Committee on Government Operations, House of Representatives, 93rd Congress, November 29-30, 1973.

2. David, M. L., Selter, R. E., and Eickhoff, W. D., "Economic Analysis of Proposed Effluent Guidelines-Feedlot Industry." Environmental Protection Agency, 1973.

3. Iowa Annual Farm Census, 1971, compiled by the Iowa Crop and Livestock Reporting Service, published by State of Iowa, Des Moines, Iowa.

4. Iowa Conservation Needs Inventory, Iowa Conservation Needs Committee, United States Department of Agriculture, Des Moines, Iowa, 1970. 229pp.

CHAPTER VIII - NEEDS AND COMPLIANCE SCHEDULES

ASSESSMENT OF NEEDS

Municipal Needs

Summer and winter waste load allocations were determined for all municipal treatment facilities (Table VI-1). Dischargers with summer and/or winter waste load allocations more stringent than secondary treatment were assigned the most stringent allocation. The DEQ has determined that advanced treatment producing an effluent with concentrations of 10 mg/l BOD_5 and 2 mg/l ammonia nitrogen is the most technologically feasible treatment that can reasonably be expected to be achieved on a continuous basis by municipalities, and therefore is the lowest limit required as a final waste load allocation. The final waste load allocations were then compared to the present discharges (Table V-2). Facilities which could not meet their waste load allocation were evaluated as to their need for additional treatment capacity. Physical needs for effective municipal sewage control can be classified into:

1. New sewer systems and treatment facilities for certain unsewered communities.
2. Upgrading to adequate secondary treatment where the present treatment level is either primary or inadequate secondary.
3. Infiltration and/or inflow (I/I) removal.
4. Advanced treatment under selective circumstances.
5. Adequate sludge disposal.

An estimation of these needs and their associated cost has been developed for the municipalities in the Skunk Basin. Several sources have been used to estimate costs. Some of these are listed below in order of priority.

1. Grant applications, based on preliminary engineering estimates or final construction costs.
2. 1974 Needs Survey.
3. EPA cost curves supplied for the 1974 needs survey.
4. State cost curves based on comparable construction costs.

All of the costs were updated to September, 1974, dollars based on EPA construction indicies (1).

New Systems - Of the 65 incorporated municipalities in the basin, 29 do not have a sewage system. These communities are presently served by individual residence septic tanks and tile drain fields. Some of these communities have a disposal problem causing either water pollution, or a health hazard, or both. This may be caused either by old systems in need of repair or replacement, or because of unsuitable site conditions such as a high ground water table, local limestone deposits, or poor soil conditions.

Most unsewered communities have a waste water disposal problem, but whether it is cost effective to construct a sewer system and treatment plant or to replace or repair existing individual septic tank systems is difficult to estimate without a detailed engineering report.

For the purpose of this study it was assumed to be cost effective to continue using individual residence septic tank systems in those communities with projected 1990 populations of less than 200. It may also be cost-effective for certain towns with populations somewhat greater than 200 to continue the use of individual septic systems, however, increased potential for possible groundwater contamination and related health problems from the use of individual septic systems by larger communities must also be weighed in a cost-effectiveness evaluation. As a result, communities with projected 1990 populations greater than 200 were assumed to have a need for a sewer system and treatment facilities while communities with projected populations of less than 200 were assumed to have no needs.

Upgrade to Secondary Treatment - All municipal facilities, except Keokuk and Ft. Madison, which provide only primary treatment, provide what is commonly referred to as secondary treatment. The Act requires that all municipal treatment facilities shall, by July 1, 1977, have treatment equivalent to secondary treatment. Many municipal secondary plants, however, cannot presently, or with projected 1990 flow, meet the new EPA and DEQ definition of secondary treatment. When compared with now quantitative definition, several municipalities are estimated to have a need to upgrade their facilities to secondary treatment.

Upgrade to Advanced Treatment - The waste load allocations analyses have pointed out several locations where treatment more stringent than secondary will be required if water quality standards are to be met. Because the new waste load allocations will be incorporated into discharge permits, several municipalities now have the need for advanced treatment facilities.

Infiltration and/or Inflow Removal - Many municipalities have infiltration and/or inflow (I/I) problems. To estimate the cost to correct I/I problems in an individual case requires detailed information concerning the systems. Without such information on accurate cost estimation is difficult. Some municipalities have been studied by consulting engineers and correction costs estimated. In addition, the 1974 Needs Survey of Municipal Wastewater Treatment Plants provides the estimated cost to study and correct I/I for a 20 percent random sampling of Iowa municipalities. For those municipalities for which an I/I correction cost estimate was available, the cost for study and correction was updated and included in the costs column of the table of needs. For those municipalities where no estimate was available for I/I correction, no costs are included because of the difficulty in making an accurate estimate without detailed information about the system. It should be realized, therefore, that the total municipal needs for the basin will be greater than what is predicted in Table VIII-5.

Most cost estimates assume that, for a given facility, it is cost effective to remove I/I rather than treat it. If it is known from engineering studies that it is cost-effective to treat I/I, those costs are included with treatment plant costs.

Sludge Disposal - Sludge disposal is a major concern at any wastewater treatment plant. A secondary municipal treatment plant produces approximately 1726 lbs. of dry solids per million gallons of water treated, or approximately 173 lbs. per 1000 people per day. When an additional contribution comes from industrial wastes, sewage sludge can become the second largest disposal problem facing a municipality, next only to garbage disposal.

Unfortunately, the job of designing a sludge disposal system, historically, seems to have been done backwards (2). The conditioning and handling design was often completed before much thought was given to actual method and site of final disposal. A more logical method of design is to first choose the final disposal method and location and then work back from that point to the most cost-effective process for getting the sludge in the best condition to accommodate the mechanics of actual disposal.

Most municipal treatment facilities in the Skunk basin handle their sludge in similar manners. After settling to concentrate solids, the sludge is stabilized either by aerobic or anaerobic digestion. Digested sludge is then usually either dried mechanically or on drying beds and finally hauled either to a landfill or farmland.

Farmland is the more common disposal location since many landfills, because of their location or equipment, cannot accept sewage sludge either wet or dry. Currently, there are three approved landfills in the Skunk Basin. Therefore all sludges are either applied to farmland or are being illegally dumped into abandoned gravel pits or unapproved landfills. Greater effort must be made to educate the farmer to the benefits of accepting treated sewage for land application. Even though some sludges contain traces of toxic metals from plating industries making them undesirable for application to certain crops, most grain crops are not influenced by these metals and with proper controls can serve as application sites.

If weather is conducive for equipment to get into the fields wet digested sludge is often applied directly to farmlands. In fact, nearly all municipalities have sludge treatment equipment although most presently apply wet digested sludge directly to farmland allowing the sludge treatment equipment to lie idle. Drying beds, for example, often become relegated to a backup status as a method of sludge handling. This is done so as to reserve their entire capacity for the wet spring season when farm fields become innaccesible.

Land disposal of sludge has the advantage of being one of the simplest methods during winter months. It is also generally one of the most cost-effective methods.

Table VIII-1 gives an indication of sludge disposal costs found in Ohio(2).

TABLE VIII-1

AVERAGE DISPOSAL COSTS (PER TON OF DRY SOLIDS)

Sludge Handling Method	Costs*
Vacuum filters, centrifuges	$34.41
Direct land application of liquid (Hauling by contract)	31.93
Drying beds (On-site storage for private individual hauling may reduce cost)	14.34
Direct land application of liquid (By city-owned trucks)	7.73

*Costs do not include digestion.

Costs to upgrade or to add additional sludge handling capacity that may be required under the basin plan have not been estimated for the municipalities in the basin. A detailed knowledge of the existing facilities, not presently available, is needed for an accurate estimate. In many cases, the cost should be small when compared with that to upgrade the existing treatment. This is, therefore, another reason why the total municipal need for the basin will be greater than what is predicted in Table VIII-5.

Summary of Municipal Needs - Table VIII-2 is a compilation of municipal treatment facility needs for the Skunk River Basin. In this table, projected flows are listed along with the concentration of BOD_5 and ammonia-N (NH_3-N) in the effluent. In addition, either the pounds projected for the 1990 discharge or the pounds allowed by the final waste load allocations (whichever is less), and a compliance schedule for meeting the waste load allocations are listed. A permit will be issued by the DEQ to the municipalities which will assure compliance with the basin plan.

Table VIII-3 summarizes the basin municipal treatment facility needs and the related investment requirements for the basin.

Table VIII-2
MUNICIPAL
ASSESSMENT OF NEEDS
AND
SCHEDULE OF COMPLIANCE***

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
1	Keokuk M-94	3.15	30/15	788/395	Upgrade primary plant to secondary treatment	9/ 6,874,000	Collector Sewers, Interceptors, Lift Station and Force Main	9/ 301,000	—	—	10/
2	Pella N.E. M-35	1.75	10/2	146/29	Upgrade to Advanced Treatment	9/ 2,340,000	Collection Sewers	10/ 25,000	6/ 6-1-76	2-1-77	12/1/78
3	Newton S.W. M-28	1.38	10/2	115/23	4/ Replace Existing Plant With Advanced Treatment	9/ 3,131,000	Collectors, Interceptors, Lift Stations, Force Mains	9/ 1,431,000	5-1-76	4-1-77	10-1-78

* In mg/l
** In mgd
1/ At such time as deemed necessary.
2/ Minor load increased due to increased population growth or new STP being constructed with increased flows.
3/ Step 1 Grant applied for.
4/ In accordance with 201 plan for Newton.
5/ Not a true representative value because of lack of 201 or 208 plans.
6/ In accordance with 201 plan for Pella.
7/ Cost estimates from DEQ & EPA cost curves.
8/ DEQ 1974 Need Survey with current dollar update.
9/ Cost values given on Grant Applications.
10/ Under construction.

*** Abbreviations Used Include:

BOD - Biochemical Oxygen Demand
C.D. - Controled Discharge
disinf. - disinfection

Eff. - Effluent
F.H.A. - Farmers Home Administration
I/I - Inflow/Infiltration Analysis
lbs. - pounds
NA - Not Available
NH_3 - Ammonia Nitrogen
Pop - Population
S.D. - Sanitary District
STP - Sewage Treatment Plant

Table VIII-2 (Continued)

ank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
4	Monroe E. M-33	0.105	10/2	9/2	Upgrade to Advanced Treatment System	8/ 382,000	None	--	8-1-76	6-1-77	12-1-78
5	Ames M-11	9.35	10/2	780/156	Upgrade to Advanced Treat-	9/ 12,932,000	Collector and Interceptor Sewer	9/ 1,138,000	3-1-76	10-1-76	6-1-78
6	Newton N.W. M-26	--	--	--	Plant to Be Abandoned	4/ 9/ 89,000	--	--	5-1-76	4-1-77	10-1-78
7	Huxley M-13	0.163	10/2	14/3	Upgrade to Advanced Treatment	8/ 560,000	None	--	6-1-77	2-1-77	8-1-78
8	Ft. Madison M-87	5.76	30/15	1441/722	Upgrade to Secondary Treatment	9/ 4,498,000	Collector, Interceptor, Force Main and Lift Station	9/ 2,076,000	--	--	10/
9	Pella N.W. M-34	--	--	--	Included in M-35	--	--	--			
10	Newton S M-31	2.325	10/2	194/39	New Advanced Treatment Facility 4/ & I/I Correction	9/ 5,969,000	Collectors, Interceptors, Lift, Station, Force Main	9/ 2,679,000	6/ 6-1-76 5-1-76	2-1-77 4-1-77	12-1-78 10-1-78
11	Washington M-65	1.360	13/3	147/34	Upgrade to Advanced Treatment	8/ 700,000	--	--	--	--	--
12	Maxwell M-21	0.096	10/2	8/2	Upgrade to Advanced Treatment	8/ 100,000	None	--	7-1-76	6-1-77	3-1-79
13	Grinnell M-47	2.527	10/2	211/42	Upgrade to Advanced Treatment	7/ 2,400,000	I/I Analysis and Sewer Evaluation	9/ 155,500	10/1/76	6-1-77	12-1-78

Table VIII-2 (Continued)

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
14	Lambs Grove M-27	--	10/2	--	Plant Abandonment	4/ 50,000	--	--	5-1-76	1/	1/
15	University Park M-36	0.055	10/2	5/1	Upgrade to Advanced Treatment	8/ 140,000	None	--	6-1-76	3-1-77	3-1-78
16	Story City M-7	0.453	10/2	38/8	Upgrade to Advanced Treatment	8/ 110,000	None	--	8-1-76	8-1-77	12-1-78
17	Melbourne M-42	0.063	30/2	16/1	New Facility with Ammonia Removal, I/I Correction	9/ 323,000	Interceptor	9/ 71,000	11-1-76	10-1-77	5-1-79
18	Sigourney E. M-57	0.1	30/2	25/2	Upgrade to Include Ammonia Removal, I/I	9/ 793,000	None	--	3-1-76	2-1-77	9-1-78
19	Mt. Pleasant M-83	1.107	13/2	120/18	Upgrade to Advanced Treatment	9/ 900,000	None	--	5-1-76	12-1-76	9-1-78
20	What Cheer M-53	0.08	30/2	20/1	Upgrade to Include Ammonia Reremoval	8/ 420,000	None	--	8-1-76	6-1-77	4-1-79
21	Colfax M-17 M-17	0.300	10/2	28/6	Upgrade to Advanced Treatment	8/ 700,000	None	--	1-1-77	1-1-78	9-1-79
22	Nevada M-18	0.80	10/2	67/13	Upgrade to Advanced Treatment	9/ 700,000	None	--	3-1-76	2-1-77	9-1-78
23	New London M-84	0.323	13/2	35/5	Upgrade to Advanced Treatment	9/ 233,000	Interceptor, Lift Station, Force Main		5-1-76	4-1-77	12-1-78
24	New Sharon M-51	0.117	30/2	29/2	Upgrade to Advanced Treatment	8/ 160,000	None	--	2-1-77	2-1-78	11-1-79

Table VIII-2 (Continued)

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
25	Kellogg M-44	0.10	30/2	25/2	Upgrade to Include Ammonia Removal	8/ 562,000	None	--	6-1-76	3-1-77	8-1-78
26	Fairfield M-79	1.60	10/2	133/27	Upgrade to Advanced Treatment	8/ 1,076,000	None	--	2-1-76	1-1-77	6-1-78
27	Sigourney W. M-56	0.105	20/2	25/2	Included in M-57 Needs		--		13/ 3-1-76	--	9-1-78
28	Oskaloosa N.E. M-37	1.185	10/2	99/20	Upgrade to Advanced Treatment	8/ 2,716,000	Collectors, Interceptors, Lift Stations, Force Mains, I/I Corrections	9/ 1,866,000	3-1-76	9-1-76	10-1-78
29	Keota M-61	0.124	30/15	31/16	Upgrade to Secondary Treatment	10/ 221,000	Included in Treatment Costs	--	11-1-76	9-1-77	5-1-79
30	Winfield M-67	0.100	13/3	11/3	Upgrade to Advanced Treatment	9/ 149,000	Collectors	8/ 106,000	5-1-76	7-1-77	6-1-79
31	Middletown M-86	0.068	30/15	17/9	New Secondary Facility	9/ 168,000	None	--	8-1-76	3-1-77	9-1-78
32	Stanhope M-10	C.D.	--	--	Third Lagoon Cell	8/ 84,000	None	--	1/	1/	1/
33	Newton E. M-30	C.D.	--	--	Plant Abandonment	4/ 15,000	--	--	5-1-76	1/	1/
34	Fremont M-75	C.D.	--	--	Third Lagoon Cell	8/ 84,000	None	--	1/	1/	1/
35	Reasnor M-32	C.D.	--	--	Third Lagoon Cell	8/ 75,000	None	--	1/	1/	1/

Table VIII-2 (Continued)

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
36	Newton W. M-29	C.D.	--	--	Plant Abandonment	4/ 15,000	--	--	5-1-76	1/	1/
37	Montezuma M-49	C.D.	--	--	Third Lagoon Cell I/I Correction	8/ 194,000	None	--	1/	1/	1/
38	Sully M-45	C.D.	--	--	None	--	None	--	--	--	--
39	Lynnville M-46	C.D.	--	--	Third Lagoon Cell	9/ 79,000	None	--	1/	1/	1/
40	Delta M-54	C.D.	--	--	Three Cell Lagoon	8/ 104,000	Complete Sewer System	8/ 480,000	1/	1/	1/
41	Barnes City M-50	C.D.	--	--	Three Cell Lagoon	8/ 83,000	Complete Sewer System	8/ 300,000	1/	1/	1/
42	South English M-59	C.D.	--	--	Three Cell Lagoon	8/ 82,000	Complete Sewer System	8/ 290,000	1/	1/	1/
43	Danville M-85	C.D.	--	--	Third Lagoon Cell and I/I	9/ 103,000	None	--	1/	1/	1/
44	Salem M-82	C.D.	--	--	Third Lagoon Cell	8/ 83,000	None	--	1/	1/	1/
45	Brighton M-63	0.048	30/15	12/6	New Secondary Plant	9/ 251,000	None	--	7-1-76	4-1-77	9-1-78
46	Ft. Madison W. M-88	0.25	30/15	62/31	None	--	None	--	--	--	--
47	West Point M-91	0.07	30/15	18/9	Upgrade to Secondary Treatment	9/ 286,000	Collectors, Interceptors, Lift Station	8/ 298,000	7-1-76	1-1-77	4-1-78

Table VIII-2 (Continued)

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collector	1974 Dollars	Facility Plans	Final Plans	Completion Date
48	Montrose M-92	0.100	30/15	25/12	None	--	None	--	--	--	--
49	Houghton M-89	C.D.	--	--	Third Lagoon Cell	8/ 72,000	None	--	1/	1/	1/
50	Keokuk H. M-93	0.0016	30/15	4/2	None	--	None	--	--	--	--
51	Cambridge M-14	C.D.	--	--	Third Lagoon Cell	8/ 14,000	None	--	1/	1/	1/
52	Elkhart M-15	C.D.	--	--	Third Lagoon Cell & I/I Correction	9/ 137,000	None	--	1/	1/	1/
53	Kelly M-12	C.D.	--	--	Three Cell Lagoon	8/ 135,000	Complete Sewer System	8/ 390,000	1/	1/	1/
54	Stockport M-80	C.D.	--	--	Three Cell Lagoon	8/ 184,000	Complete Sewer System	8/ 360,000	--	--	10/
55	Hillsboro M-81	C.D.	--	--	Three Cell Lagoon	8/ 89,000	Complete Sewer System	8/ 350,000	1/	1/	1/
56	Hedrick M-39	C.D.	--	--	Third Lagoon Cell	8/ 97,000	None	--	1/	1/	1/
57	Laurel M-43	C.D.	--	--	Three Cell Lagoon	8/ 89,000	Complete Sewer System	8/ 330,000	1/	1/	1/
58	Ollie M-41	C.D.	--	--	Three Cell Lagoon	8/ 86,000	Collectors	8/	1/	1/	1/
59	Jewell M-5	C.D.	--	--	Third Lagoon Cell	8/ 111,000	None	--	1/	1/	1/

Table VIII-2 (Continued)

		Waste Load Allocation			Needs				Schedule of Compliance		
Rank	Dischargers	1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
60	Roland M-8	C.D.	--	--	Third Lagoon Cell	8/ 97,000	None	--	1/	1/	1/
61	Gilbert M-9	C.D.	--	--	Third Lagoon Cell	8/ 85,000	None	--	1/	1/	1/
62	Williams M-1	C.D.	--	--	Third Lagoon Cell	8/ 82,000	None	--	1/	1/	1/
63	Ellsworth M-2	C.D.	--	--	Upgrade Existing Facility	9/ 1,067,000	Interceptor, Lift Station and Force Main	9/ 29,000	2-1-77	1-1-78	2-1-79
64	Blairsburg M-3	C.D.	--	--	Third Lagoon Cell	8/ 76,000	None	--	1/	1/	1/
65	Kamrar M-4	C.D.	--	--	Three Cell Lagoon	8/ 84,000	Complete Sewer System	8/ 300,000	1/	1/	1/
66	Wayland M-71	C.D.	--	--	Third Lagoon Cell	8/ 93,000	None	--	1/	1/	1/
67	Agency M-76	C.D.	--	--	Third Lagoon Cell	8/ 102,000	None	--	1/	1/	1/
68	Packwood M-77	C.D.	--	--	Third Lagoon Cell	8/ 70,000	None	--	1/	1/	1/
69	Richland M-62	C.D.	--	--	Three Cell Lagoon	8/ 81,000	Complete Sewer System	8/ 280,000	--	--	10/
70	Batavia M-78	C.D.	--	--	Three Cell Lagoon	8/ 200,000	Complete Sewer System	8/ 560,000	--	--	10/
71	Harper M-60	C.D.	--	--	Three Cell Lagoon	98,000	Complete Sewer System	8/ 420,000	1/	1/	1/

Table VIII-2 (Continued)

Rank	Dischargers	Waste Load Allocation			Needs				Schedule of Compliance		
		1990 Flow**	Concentration* BOD_5/NH_3	lbs.Eff. BOD_5/NH_3	Treatment	1974 Dollars	Collection	1974 Dollars	Facility Plans	Final Plans	Completion Date
72	Crawfordsville M-69	C.D.	--	--	Three Cell Lagoon	8/ 89,000	Complete Sewer System	8/ 350,000	1/	1/	1/
73	Lockridge M-73	C.D.	--	--	Three Cell Lagoon	8/ 85,000	Complete Sewer System	8/ 320,000	1/	1/	1/
74	Olds M-68	C.D.	--	--	Three Cell Lagoon	8/ 84,000	Compete Sewer System	8/ 320,000	1/	1/	1/
75	West Chester M-64	C.D.	--	--	Three Cell Lagoon	8/ 81,000	Complete Sewer System	8/ 280,000	1/	1/	1/
76	Mt. Union M-66	C.D.	--	--	Three Cell Lagoon	8/ 81,000	Complete Sewer System	8/ 280,000	1/	1/	1/
77	Baxter M-25	C.D.	--	--	Third Lagoon Cell & I/I Correction	9/ 144,000	None	--	1/	1/	1/
78	Colo M-20	C.D.	--	--	Third Lagoon Cell & I/I Correction	9/ 135,000	Collectors	9/ 70,000	11-1-76	10-1-77	12-1-78
79	Collins M-22	C.D.	--	--	Third Lagoon Cell	8/ 80,000	None	--	1/	1/	1/
80	Rhodes M-24	C.D.	--	--	None	--	None	--	--	--	10/
81	McCallsburg M-19	C.D.	--	--	Third Lagoon Cell	9/ 76,000	None	--	1/	1/	1/
82	Mingo M-23	C.D.	--	--	Third Lagoon Cell	8/ 74,000	None	--	1/	1/	1/

TABLE VIII-3

SUMMARY OF MUNICIPAL TREATMENT NEEDS

Treatment Type Need	No. of Facilities	1974 Dollars
Advanced Treatment	23	$37,496,000
New Secondary STP	2	419,000
Upgrade to Secondary Facility	4	11,879,000
Three Cell Lagoon	19	1,923,000
Upgrade Existing Lagoon Facility	1	1,067,000
Add Third Lagoon Cell	24	2,257,000
Facility Abandonment	4	222,000
No Need	5	
Maintain Septic Tanks	12	
TOTAL	94	$55,263,000

Industrial Needs

Iowa has become increasingly more industrialized. Many industries are agriculturally oriented, such as meat packing and processing, dairy and cheese processing, fertilizer and pesticide production, wet grain milling, and rendering. All of these are "wet" industries (using large quanitites of water) and produce inordinately large amounts of waste which are difficult to treat by conventional methods. In the Skunk River Basin most of the industries discharge to municipal treatment facilities. Sometimes they cause an overload condition upon the municipal plant.

The majority of industry in the basin is "dry" (using little or no water) such as metal fabrication (for furnaces and appliances), and printing.

Most industries in the Skunk River Basin that discharge do not have any sort of waste treatment, although many have only cooling water discharges. The few which have process wastewater discharges are planning or are under current order to build treatment facilities.

The DEQ, through the State Operation Permit Program, in coordination with the Federal NPDES Discharge Permit Program will regulate industrial dischargers. Effluent limits are set according to the waste load allocations. BPT is the minimum allowable allocation.

Table VIII-4 lists the significant industrial discharges in the basin, their present discharge, waste load allocation, projected need, and a compliance schedule. A permit will be issued by the DEQ to the industry, which will assure compliance with the basin plan.

According to the schedules of compliance for the significant industrial dischargers, a reduction of industrial waste loads of 83% and 84% of BOD_5 and ammonia-nitrogen, respectfully, is expected. This reduction is estimated to cost the industries approximately 19.3 million dollars. This cost estimation was derived from a DEQ survey of the significant industries.

Semipublic

The major semipublic wastewater disposal problem is water treatment plants. Many of these plants use lime (calcium hydroxide) to soften the water before distribution. The sludge created poses a significant disposal problem.

Most facilities lagoon the sludge, but this does not answer the final disposal problem of what to do when the lagoons are full. Some plants discharge their lime sludge directly to the river. These plants are currently studying methods to eliminate such discharges.

Lime sludge does have an economic value if handling problems can be overcome. The sludge can be used for landfill, or as a pH buffer on farmland which has acidic soil. Recently concrete manufacturers have expressed an interest in the material, since it is one of the major ingredients in their product.

TABLE VIII-4

TREATMENT NEEDS AND SCHEDULE OF COMPLIANCE FOR SIGNIFICANT INDUSTRIES

Industrial Discharger	Flow MGD	Present Eff.lbs.- BOD/NH_3	7/1/77 Eff.lbs.-	Treatment Needs	Schedule of Compliance		
					Preliminary Report	Final Plans	Completion Date
Maytag Dairy Farms I-8	.0044	18.7/-	40/-	Septic Tank Tile Field System	--	--	7/1/76
Smith & Jones, Inc. I-15	.071	27/6	8/3	New Treatment Facility	--	--	7/1/75
North American Rockwell Corp. I-29	.080	(53/3)*	(53/3)*	None	--	--	--
		*COD/Oil & Grease Values					
Iowa Ammunition Plant I-36	.800	-/-	7.5/13	Upgrade Existing Facility	--	--	7/1/75
First Mississippi, Inc. I-37	--	-/-	-/-	Maintain Recycle System	--	--	--
Armour-Dial, Inc. I-38	2.00	700/313	363/313	New Treatment Facility	11/1/74	3/1/75	7/1/75
Consolidated Packaging Co. I-39	.685	12300/	1570/	New Treatment Facility	--	--	3/30/77
Atchison, Topeka & Santa Fe R.R. I-40	--	-/-	-/-	Suspended Solids and Oil & Grease Removal Facility	--	1/1/75	12/31/75
W. A. Sheaffer Pen Co. I-41	.960	-/-	-/-	Treatment of Heavy Metals and Oil & Grease	--	--	7/1/76

TABLE VIII-4

TREATMENT NEEDS AND SCHEDULE OF COMPLIANCE FOR SIGNIFICANT INDUSTRIES

Industrial Discharger	Flow MGD	Present Eff.lbs.- BOD/NH_3	7/1/77 Eff.lbs.-	Treatment Needs	Schedule of Compliance		
					Preliminary Report	Final Plans	Completion Date
Chevron Chemical Co. I-44	60.0	1950*/1200 *COD Value	-/98	Upgrade Existing Facility	9/1/75	--	7/1/77
American Metal Climax I-47	Under construction of a package activated sludge plant for sanitary wastes only.						
Burlington Northern, Inc. I-48	.001	.5/-	.25/-	Upgrade Existing Facility	6/30/75	8/30/75	6/30/76
Midwest Carbide Corp. I-49	.048	7.6/-	0/-	Eliminate Contamination of Cooling Water	--	--	9/1/75
Sheller Globe Corp. I-50	.03	22.3*/- *COD Values	2.5*/-	Upgrade Existing Facility	--	--	9/1/74
Hubinger Co. I-51	5.125	6411/-	1300/-	Provides for B.P.T.	--	--	3/1/75
Union Electric I-52	1.877	-/-	-/-	New System for Sanitary System	--	--	7/1/75
Foote Mineral I-54	.5	-/- *Oil & Grease Values	42*/-	Suspended Solids and Oil & Grease Removal Facility	3/30/75	6/30/75	7/1/76
		19464.8/2141	3919.3/411				

As pressure is brought to bear on water treatment plants from government agencies and landowners located adjacent to sludge lagoons, lime sludge disposal will receive greater attention.

An estimate of semipublic needs and related costs to meet the basin plan has not been performed due to a lack of information detailing the facilities.

Nonpoint Source Needs

Nonpoint sources of pollution have been divided into the three main areas of: general rural runoff, animal feeding operations, and urban nonpoint sources. Each of the three areas has been discussed in Chapter VII, and in greater detail in the Supporting Document (3).

General Rural Runoff - The major pollution parameters in general rural runoff have been classified as sediment, nutrients, and organics. Sediments is usually the parameter of most significance.

Nutrients can also be of major significance especially if they will affect near-by lakes or impoundments. Runoff from cropland is a major source of nutrients. Nutrient pollution abatement is accomplished through improved methods of fertilizer application and implementation of the same measures used to control soil loss.

Except where runoff occurs from animal feeding operations, organics are usually of relatively minor importance, especially when compared with the contribution from municipalities.

Physical needs for abating general rural runoff pollution reduce to those methods employed for controlling soil loss. These methods have been discussed in some detail in the supporting document. An estimate to implement such control measures in the Skunk Basin was presented in Chapter VII. The estimated capital investments amounted to approximately 141 million dollars.

Animal Feeding Operations - The major pollutants from animal feeding operations are suspended solids, nutrients, and organics. Physical needs to control these sources of pollution have been summarized as including debris basins and retention basins, with land application for final disposal. An estimated capital investments to implement such control measures in the Skunk River Basin amounted to approximately 3.1 million dollars.

In urbanized areas, surface runoff and combined sewer overflow can adversely affect the utility of the water resource. Contaminants discharged to a water course are the result of debris, animal droppings, eroded soils, tire and vehicular exhaust residues, deicing compounds, pesticides, fertilizers, air pollution fallout, and decayed vegetation contained in the urban runoff. The estimated capital investments to implement control measures in the Skunk River Basin amounted to approximately $204 million dollars.

Summary of Needs

The total dollar need to meet the objectives of this basin plan for the Skunk River Basin is estimated to exceed million dollars. This amount is broken down in Table VIII-5.

TABLE VIII-5

SUMMARY OF NEEDS

Need	Approximate Dollars*
Municipal Treatment	55,263,000
Municipal Collection and Combined Sewer Overflow Correction	18,645,000
Industrial Treatment (Significant Industries)	19,300,000
Animal Feeding Operation Controls	4,594,000
Soil Loss Controls	141,387,000
Urban Stormwater Treatment and/or Control Costs	204,300,000
TOTAL	443,489,000

*1974 Dollars

REFERENCES

1. Sewage Treatment Plant and Sewer Construction Cost Indes, U.S EPA Office of Water Program Operations, Municipal Construction Division.

2. Manson, R. J. and Merrit, C. A., "Land Application of Liquid Municipal Wastewater Sludges", Water Pollution Control Federation Journal, Vol. 47, No. 1, January, 1975.

CHAPTER IX - CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Several significant conclusions have arisen throughout the development of this basin plan. Some of these include:

1. The Skunk River Basin currently has 87 incorporated mu-municipalities with a total population of 178,923. The population of these municipalities is projected to increase by 39 percent to 248,646 by 1990.

2. Of the 87 incorporated municipalities, 53 currently have collection and treatment facilities and 29 communities have no central sewerage system. Many of the treatment facilities are not presently achieving secondary treatment.

3. The waste stabilization lagoon serves nearly 50 percent of the municipalities and a large number of industries within the basin.

4. Water Quality violations have been documented during high stream flows. These pollution problems can probably be attributed to agricultural and urban runoff.

5. Sediment, which often carries other pollutants with it, is a significant pollution parameter in Iowa. Proper land and water management can minimize soil erosion. Effort should be made to continue and increase the use of established soil conservation practices. A few of these practices involve only alternate land management with greater benefit resulting from the same monetary

outlay. This can also be true for certain pollutants carried with sediment. Pesticides in the environment can be reduced by using soil conservation practices and fertilizer loss can be minimized by application methods which assure efficient uptake by crops.

6. All lakes and impoundments in the basin are subject to potential eutrophication from rural and urban runoff.

7. Land disposal of digested municipal sewage sludge presently is the most economical ultimate disposal method currently being used in the planning area.

8. Waste load allocations have shown that a significant number of dischargers will be required to provide advanced waste treatment to meet water quality standards at the 7-day, 1-in-10 year low streamflow.

9. The water quality strategy for point sources, as outlined in the plan, should result in maintaining acceptable surface water quality for designated uses.

10. The Skunk River Basin plan has demonstrated (Chapter VIII) need for municipal treatment and collection facilities which may exceed a cost of 71 million dollars.

11. Most industries should be able to meet the July 1, 1977 requirements of the Act. A high percentage of municipalities will also meet this deadline, however, long construction schedules and lack of adequate grant funding will result in some municipalities not meeting the

deadline. The 1983 goal requiring all streams to be of suitable water quality to be fishable and swimmable can be met if Federal funding is continued.

12. The Skunk River Basin, with exception of the Mississippi River, is water quality limited.

13. Problems occur as a result of waste discharges into intermittent streams in the basin which have an average 7 day 1-in-10 year low flow ranging from 0-1 cfs. At these low flows, the streams are unable to satisfactorily assimilate any significant discharges of organic wastes.

RECOMMENDATIONS

As stated in the Introduction, the objective of this Basin Plan is to provide the framework for achieving the protection and maintenance of surface and ground water quality in the Skunk River Basin. The implementation of this Basin Plan will help in attaining that objective. However, several possibilities exist that would further aid this effort. It is therefore recommended that the following topics be given further consideration and study.

1. The State Water Plan, which is currently under development, should give careful consideration to water quality. Consideration should also be given to restricting future water uses in water quality limited segments.

2. Non-structural management measures that can enhance and protect water quality should be given careful consideration by all levels of government, business interests and private citizens.

   Examples include:

   a. Improved operation should be initiated at all waste treatment systems. Small communities may be able to accomplish this goal by sharing qualified operators and laboratory facilities.

b. Land use planning and zoning decisions should include considerations of water quality. This is particularly important when development around lakes may occur.

c. Local government should give consideration to the impact on water quality before making commitments for new development or industry.

d. Tillage practices should be selected that will minimize soil erosion.

e. Woodland management practices should be selected that will minimize soil erosion.

f. Agricultural chemicals should be applied at rates and times that will minimize runoff of fertilizers and herbicides.

g. The design of any new or expanded industrial or commercial facilities should give careful consideration to minimize the amount of waste products that will be discharged from that facility.

h. Recycling should be encouraged and selected even when marginally cost-effective on the assumption that the cost of all natural resources will increase in the future.

i. Strict enforcement of local ordinances should be practiced. Such ordinances should include provision for rigid inspection of all new sewer construction and connections.

j. County Boards of Health should adopt and enforce individual waste disposal system regulations promulgated by the State Health Department.

k. Sanitary districts should be established to provide sewerage services to unincorporated areas.

l. Although thermal discharges are not considered to be a major problem in the study area, they are significant enough that further studies are warranted to determine specific thermal limits.

m. Land disposal of wastewater should be considered where soil and other conditions permit, and complete retention lagoons rather than small mechanical treatment plants should be considered where applicable, in view of the national goal of zero discharge of pollutants by 1985. The communities, assisted by the Department of Environmental Quality, are responsible for considering this in their plan alternatives.

n. It is known that urban runoff contains metals and other pollutants, but their impact on downstream water uses needs further studies. Urban runoff can be controlled by storage and treatment.

Economic feasibility studies should be performed for all major municipalities.

o. Land disposal of digested municipal sewage sludge is the most economical ultimate disposal method presently used. Many communities let sludge drying equipment lie idle much of the time, preferring to wet haul sludge when farmland is conducive to allow equipment into the fields. Departmental policy should address this disposal problem. An educational program might be worthwhile to emphasize the economic advantages of using sludge as a soil conditioner and fertilizer supplement.

p. Establishment of specific waste load allocations has indicated certain areas where regionalization of facilities should be considered. In addition to combining industrial discharges with publicly-owned facilities, combinations of municipal facilities are possible.

(1) Facility Planning - It is recommended that detailed evaluations should be performed as an element of the Section 201, Step 1 Facilities Planning for regionalization of waste treatment facilities in the following areas:

Fort Madison Area - Fort Madison, First Mississippi, Armour-Dial, Landon Mill, Santa Fe Railway, Sheaffer Pen, DuPont, Fort Madison Westerly Lagoon, Breck, Chevron Chemicals.

Keokuk Area - Keokuk, Sheller Globe, Midwest Carbide, Hubinger, Foote Mineral, Keokuk Steel Casting, Union Electric.

Kellogg Area - Smith-Jones, Inc., Kellogg

Pella Area

Oskaloosa Area

(2) Areawide Planning - The Des Moines Metropolitan area has been officially designated by the Governor as a 208 areawide planning area. This area includes the City of Elkhart, which is in the Skunk River Basin. The planning agency for the area is the Central Iowa Regional Association of Local Governments (CIRALG). No other areas in the basin are recommended for similar designation.

(3) Other - At the community and county level zoning and land use planning should be used to assure an orderly and efficient development of unsewered areas.

3. Structural measures will of course also help to protect water quality. Many of the structural measures required in the basin are outlined in the needs table.

CHAPTER X - REVIEW AND REVISION

PUBLIC HEARING PROCEDURE

Public hearings are specified by the Federal Water Pollution Control Act Amendments of 1972 as part of the procedure for establishing a water quality management plan for river basins. In accordance with Section 101(e) of the Act, public participation was required on significant elements of the planning process.

Statements or presentations given at public hearings were required to be retained in writing for the record. Verbal comments and written statements were specified to be limited to the Water Quality Management Plan. Written statements were requested to be submitted to DEQ at least one week prior to the hearing. Additional statements, filed within ten days after the scheduled hearing, were also considered part of the record.

"Reasonable Notice" was given to the public by prominent advertisement, indicating time, date, place, and availability of proposed plan, 30 days prior to the date of each hearing. Complete records of such hearings are kept and a transcript made available on payment of fee.

WATER QUALITY STANDARDS REVIEW

The Federal Act specifies that at least every three years, starting from date of enactment of the 1972 Amendments, the Iowa Water Quality Commission hold public hearings for purpose of review, and/or revision, of the Iowa Water Quality Standards. The 303(e) process, including this basin plan developed as part of the process, is used to assist in making any necessary revisions of Iowa Water Quality Standards. The Iowa Water Quality Standards are scheduled for revision in 1976.

BASIN PLAN REVISION

This Basin Plan is Phase I of the annual continuing planning process as required by section 303(3) of the Act. This basin plan will be revised under Phase II in such manner as is necessary to maintain its viability. Thereafter, this Basin Plan will be reviewed annually and revision will be made if warranted. Revision to the wasteload allocations, compliance schedules, or construction grant needs and priorities will be based on the most current and accurate data available.

BASIN PLAN HEARING

A public hearing concerning the adoption of the proposed Skunk River Basin Water Quality Management Plan was conducted by the Department of Environmental Quality. The hearing was held November 13, 1975, at 7:30 p.m. at the Oskaloosa City Hall, S. Market and Second Avenue E, Ottumwa, Iowa. A copy of the public notice announcing the hearing appears in this chapter.

Identified in the following list are persons who attended the hearing:

Name	Representing
John Phillips	Mahaska Co. Conservation Board
Sandy Dusenbery	League of Women Voters
Lyle Boender	City of Oskaloosa
C. B. Cladwell	City of Pella
C. C. Converse	City of Oskaloosa
Dr. Merwin D. Dougal	Iowa WRRI, ISU
John Hesling, P.E.	Garner & Assoc.
Ann Morris	League of Women Voters
Michael L. Nissen	City of Nevada
Harris F. Seidel	City of Ames
H. R. Veenstra	Veenstra & Kimm
Leland McCash	City of Winfield
Keith Miller	City of New Sharon
James Preilla	City of Oskaloosa
Ray Barber	City of Winfield
Victor E. Ziegler	EPA
T. Al Austin	ISU
Ray Kresha	KBOE Radio
Jane M. Coffey	Oskaloosa Daily Herald
Henry Fischer	Pella Chronicle
Bass Van Gilst	State Senator
Leslie Jones	Self
J. Fred Moyer	Self
John W. Carty	City of Winfield
Theresa Davis	City of Oskaloosa
R. R. Scharff	Self
Richard E. Nordenson	Oskaloosa C of C

Name	Representing
John L. Franklin	H. R. Green Co.
Dennis Lanstreet	City of Pella
Harold E. Woods	City of Sigourney
W. M. Jackson	Self
Mrs. D. R. Smith	Self
R. C. Russell	Self
Matt Thomas	Self
Cornie Boender	City of Oskaloosa
C. D. Gordon, Jr.	City of Oskaloosa
Stanley Kirley	City of Oskaloosa
Ronald Neil	City of Pella
Norman A. Theelke	City of Oskaloosa
Craig Olson	City of Marshalltown
Robert J. Hunt	Chevron Chemical
Dwight McCaen	City of New Sharon
Carl Boget	SCS
Lloyd M. Patterson	SCS
Ralph J. Russell	Howard R. Green Co.
Jack R. Polson	IAAP
E. R. Smith	Henry Co. Observation Group
Larry Espy	Henry Co. Conservation Board
Rex Thomas	Henry Co. Conservation Comm.
Dan Lindquist	DSC
Don Honson	State Soil Conservation Comm.
Fred Higginbottom	DSC
Stephan E. Jones	ISU Extension
Harold F. McLeran	Henry Co. Conservation Board
Larry Rodruck	City of Winfield
Ted Brinton	Powers-Willis & Assoc.
Ruth Crookham	Self

iowa department of environmental quality

NOTICE OF PUBLIC HEARING

The Iowa Department of Environmental Quality (DEQ) will hold a public hearing concerning the adoption of the proposed Water Quality Management Plan for the Skunk River Basin on November 13, 1975, at 7:30 p.m. at the Oskaloosa City Hall, S. Market & 2nd Ave. E., Oskaloosa, Iowa.

The Water Quality Management Plan is specifically directed toward satisfying the requirements of Section 303(e) of the Federal Water Pollution Control Act, as amended, Public Law 92-500, 86 Statute 849 (1972); (33 United States Code Annotated 1313(e)). The purpose of the Water Quality Management Plan is to identify the water quality problems of the Skunk River Basin and to set forth a program to correct the problems.

This public hearing is held pursuant to Subsection 455B.32(7) of the Code of Iowa and 40 Code of Federal Regulation Part 131.502 (Federal Register, Volume 39, 19643, June 30, 1974).

Written statements may be submitted to DEQ any time before the hearing, during the hearing and for ten days after the close of the hearing. Oral statements will be taken at the hearing. Time limits on oral presentations may be imposed, if necessary.

Copies of the proposed plan are available for inspection in the city clerk's office in the county seat of each county located in, or partially in the Skunk River Basin and at each of the six DEQ regional offices. Written statements and requests for additional information should be addressed to the Water Quality Management Division, Iowa Department of Environmental Quality, 3920 Delaware Avenue, P.O. Box 3326, Des Moines, Iowa, telephone 515/265-8134.

WATER QUALITY MANAGEMENT DIVISION

Joseph E. Obr, P.E., Director

The substantive comments (both written and oral) for all six basin plans presented at the hearings and/or directly submitted to the DEQ office in Des Moines, have been compiled. Responses made by the DEQ staff were then presented to the Iowa Water Quality Commission. Those commenting on the plan included federal and state agencies, county and local governments and agencies, industrial organizations, local citizens and special interest groups. Many of these comments have been adopted or substantially justified by change, deletion from, or additions to the basin plans. The Commission approved the plans and copies along with the comments and responses were sent to the Region VII office for EPA's approval. Oral and written statements presented at the hearings are available at the DEQ office for inspection. Copies may be obtained from the DEQ for a reproduction fee.

The DEQ has revised the plans in responses to issues raised, which could be resolved easily and not slow the progress of the study. If, however, it cannot readily be resolved and is a major issue, the issue will be addressed in Phase II of the planning process.

The water quality standards and the stream classifications will be reviewed in 1976. The DEQ, in cooperation with the Iowa Conservation Commission, will evaluate stream use and classification. The chemical and physical parameters listed in the standards will also be subject to review. Public hearings will be held prior to commission approval.

The stream segment and discharger ranking methodology, as required by Sec. 303(e) of the Act, may be the basis for future construction grant funding. Before any future grant priority list is compiled, which may be based on new priority formulas, the methodology will be reviewed and public hearings held. The discharger ranking used in the basin plans basically assumes that dischargers creating the greatest impact on water quality will be addressed more quickly than dischargers with less impact. This methodology will be expanded before it is used for the construction grant ranking.

New data regarding the seven-day ten-year low flow is now available and new population projections are expected. This will necessitate updating many waste load allocations in the Phase II planning program.

As stated earlier, 303(e) basin planning, or Phase I, mainly addressed point source pollution abatement. Under EPA (Phase II) guidelines, states are required to fully address nonpoint source pollution and to develop abatement programs to handle the problem. Phase II planning will continue to include point source waste load allocations and time schedules, and will update the municipal needs tables. Much of this will concern locating errors, or be tied to stream reclassification, new low flow data or standards revision.

The goal of Phase II planning is to reassess controls and needs of combined sewer replacement, feedlot control, urban runoff, and rural nonpoint pollution and to assign implementation programs.

GLOSSARY

Activated sludge is a completely aerobic treatment process by which wastewater is fed continuously into an aerated tank where microorganisms metabolize the organic material. The biological floc is settled in a final clarifier and may be recirculated to the aeration basin. Ninety to ninety-five percent BOD removal can be achieved.

Aerobic denotes biological processes in which oxygen is used for the decomposition of organic matter.

Anaerobic denotes biological processes in which decomposition of organic matter is accomplished in an environment devoid of free oxygen.

Biochemical oxygen demand (BOD) is the quantity of oxygen utilized in the biochemical oxidation of organic matter in a specified time and at a specified temperature.

Combined sewer is designed to carry sanitary sewage, industrial wastes, and storm runoff in a single conduit.

Disinfection of water or wastewater is a method of reducing pathogens or objectionable microorganisms by means of chemicals or other acceptable means.

Dissolved oxygen is the concentration of oxygen dissolved in a liquid. If affects biological changes brought about by aerobic or anaerobic organisms, and is an important environmental factor for growth and reproduction of fish and other aquatic organisms. Determination of dissolved oxygen also serves as the basis of the BOD test.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of gage height or discharge are obtained.

Holding or storage pit is a covered container into which wastewater flows until it can be pumped out and taken to a treatment facility.

Industrial wastewater is the wastewater which originates in industrial processing, cooling, or washing operations.

Infiltration is the groundwater which gains entrance to sewers through joints or improper connections.

Intermediate treatment involves additional settling of the wastewater and may incorporate chemicals to aid the settling process. Normally 50 percent BOD removal may be obtained through this process.

Intermittent stream is a stream with 7-day, 10-day low flow less than 0.1 cubic feet per second.

Lagoon or stabilization pond is generally a shallow geometrical pond which treats pretreated or untreated sewage biologically. Wastewater is retained in the pond for treatment and a clarified effluent is discharged after a specific detention time.

Main sewer is a conduit to which one or more branch sewers are tributary.

Outfall sewer receives the wastewater from a collection system and carries it to a point of final discharge.

pH is the negative logarithm of the hydrogen ion concentration. A pH below 7 indicates an acid condition and a pH above 7 indicates an alkaline condition.

Population equivalent measures the strength of a wastewater in terms of an equivalent number of persons, using an average 0.17 pounds of oxygen demand per person per day in domestic wastewater.

Pretreatment of industrial waste refers to treatment, usually primary, given to the wastewater before it is discharged into a sanitary sewer for secondary treatment.

Primary treatment involves only screening and physical settling of the wastewater. Approximately 30 percent of the BOD can be removed through this process.

Sampling station is a particular site on a stream, lake, canal or reservoir where systematic samples of water are taken for analysis for physical, chemical, or biological parameters.

Sanitary sewer is a conduit designed to carry sanitary sewage. However, in many cases, it will also carry industrial wastes produced in the area it serves.

Secondary treatment conventionally involves biological treatment of wastewater to reduce the BOD by 85 percent or more. These biological processes usually involve trickling filters, stabilization ponds, or activated sludge processes. Recently, straight physical-chemical processes have been considered secondary treatment on the basis of their BOD removal efficiency.

Septic tank allows solids to settle out of a waste and permits a clarified effluent to be discharged to a ground seepage system. The solids are broken down anaerobically, and the residue must be pumped out periodically.

Sewage disposal applies to the act of disposing of sewage by any method. It may be done with or without any previous treatment of the wastewater.

Sewage treatment refers to any artificial process to which wastewater is subjected in order to remove or alter its objectionable constituents so as to render it less dangerous or offensive.

Sewage treatment plant is a comprehensive term encompassing an arrangement of devices and structures for treating domestic and industrial wastewater and sludge.

Sewerage is a system of sewers and appurtenances for the collection, transportation, pumping, and treatment of domestic and industrial wastewaters.

Solids are all matter except water contained in a liquid. They may be suspended or dissolved solids.

Storm runoff is the wastewater flowing due to rain water, snowmelt, or other surface runoff.

Storm sewer carries storm runoff and similar waters not including sanitary or industrial sewage.

Trickling filter systems consist of a bed of crushed rock, or other media, coated with biological films, through which primary effluent is passed for secondary treatment. The filter may be followed by a final settling basin, and recirculation through the filter may be employed for better removal. Up to 90 percent BOD removal can be achieved through trickling filter systems in ideal situations.